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Deputy General Counsel

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May 17, 2021

VIA ELECTRONIC FILING

The Honorable Jocelyn G. Boyd
Chief Clerk and Executive Director
Public Service Commission of South Carolina
101 Executive Center Drive, Suite 100
Columbia, SC 29210

**Re: Joint Petition of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC to Establish a Consolidated Informational Docket for Review and Consideration of Grid Improvement Plans (NDI Opened Pursuant to Commission Order No. 2020-533)
Docket No. ND-2020-28-E**

Informational Update on Stakeholder Meeting Held May 12, 2021

Dear Ms. Boyd:

On August 12, 2020, by Order 2020-533 in Docket No. 2019-381-E, the Commission approved Duke Energy Carolinas, LLC's ("DEC") and Duke Energy Progress, LLC's ("DEP") (collectively, the "Companies") joint request to establish an informational docket for review and consideration of its Grid Improvement Plans. As a result of that order, on August 14, 2020, the Commission opened the above-referenced NDI docket.

On April 15, 2021, the Companies filed the 2020 Grid Improvement Plan Status Report for DEC and DEP. This report showed how the Companies are performing in terms of program costs and units compared to its targets.

On May 12, 2021, the Companies held a South Carolina Grid Improvement Plan 2020 Status Report virtual forum. During this session, subject matter experts discussed 2020 program benefits and accomplishments, highlighted upcoming stakeholder engagement opportunities and were available for additional questions submitted during the forum. A survey will be sent to participants to learn what other topics would be of interest to participants in future engagements.

The following attachments enclosed with this update provide additional information on the virtual forum.

- Attachment A: Save the Date
- Attachment B: Save the Date and Invitation Distribution List
- Attachment C: Invitation to Virtual Forum

- Attachment D: List of Forum Attendees
- Attachment E: South Carolina Grid Improvement Plan 2020 Virtual Forum Presentation
- Attachment F: Virtual Forum Follow-Up Survey

The Companies will continue to inform stakeholders, the ORS and the Commission on developments in the Companies' Grid Improvement Plans.

Sincerely,

Heather Shirley Smith

Heather Shirley Smith

Attachments

cc: (via email w/ attachments)

Counsel for Office of Regulatory Staff
Department of Consumer Affairs
Counsel for Sierra Club
Counsel for Walmart, Inc.
Counsel for SELC on behalf of SC NAACP, SCCCL & Upstate Forever
Counsel for Nucor Steel-South Carolina
Counsel for SCSBA and Cypress Creek Renewables
Counsel for SCEUC
Counsel for Vote Solar
Counsel for CMC Recycling
Hasala Dharmawardena

ATTACHMENT A

Underwood, Lizzy

From: Davidson, Hilary
Sent: Tuesday, April 6, 2021 2:08 PM
Subject: Save the Date: Duke Energy South Carolina 2020 GIP Status Report Virtual Forum

As a stakeholder who has expressed an interest in Duke Energy's Grid Improvement Plan (GIP) initiatives, we are happy to announce our plans to host a 2020 South Carolina GIP Status Report Virtual Forum. During the forum, tentatively scheduled from 1:00 PM – 2:00 PM on May 12th, 2021, we will review the report, share insights and answer questions.

We intend to file the 2020 South Carolina GIP Status Report in Docket No. ND-2020-28-E by mid-April, and will include the link to the filing in a follow-up email to you, along with additional details about participating in the forum. In the interim, if you wish to participate, please save the date and time on our calendar.

Thank you very much for your continued interest in Duke Energy's Grid Improvement Plans. If you have any questions, need additional information or if you would like to request a topic to be covered in the forum, please feel free to reach out to GIP-Engagement@duke-energy.com.

Sincerely,

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ATTACHMENT B

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ATTACHMENT B

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ATTACHMENT B

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ATTACHMENT C

Underwood, Lizzy

From: Davidson, Hilary
Sent: Monday, April 1 , 2021 :02 PM
Subject: FI A ou are invited 0 12 Duke Energy Virtual Forum 2020 SC Grid Improvement Plans Status Report

Good afternoon,

We'd like to invite you to a virtual forum that we are hosting on May 12th, 2021 from 1:00 – 2:00 p.m. The purpose of the forum is to update interested stakeholders on the continued progress we have made on the Grid Improvement Plans, provide program and pro ect highlights, listen to your feedback and respond to any questions that you may have. In Docket No. ND-2020-28-E, you can find the 2020 SC GIP Status Report for your review.

If you wish to participate in the virtual forum, we ask that you **please register by Wednesday, May 5th using this link**: Register here

For assistance with registration, please email: Eventsupport@duke-energy.com. If you have any questions, need additional information or if you would like to request a topic to be covered in the forum, please feel free to reach out to GIP-Engagement@duke-energy.com.

Thank you very much for your continued interest in Duke Energy's Grid Improvement Plans, and we hope that you will oin us on May 12th.

Sincerely,
Hilary S. Davidson
Director, Stakeholder Engagement
Duke Energy Corporation
980.373.5738
hilary.davidson@duke-energy.com

ATTACHMENT D

Brown, Joanne	Duke Energy
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Clark, Leslie S	Duke Energy
Dave Rogers	Sierra Club
Davidson, Hilary	Duke Energy
DeRoberts, Emily K	Duke Energy
Duffy, Kris C	Duke Energy
Epps, Ashley Hollis	Duke Energy
Hamilton Davis	Southern Current
Henderson, Megan E.	Duke Energy
Hescock, Taylor	Duke Energy
Hipp, Dawn	SC ORS
Hyatt, Randy	Duke Energy
John Ruoff	The Ruoff Group
Knowles, Alex	SC ORS
Maggie Shober	Southern Alliance for Clean Energy (SACE)
Maley, Daniel J	Duke Energy
Manogaran, Indu	SC ORS
Mc Craw, Kenneth L	Duke Energy
Moore, Eugene	Duke Energy
Mustian, Ben	SC ORS
Oliver, Jay W	Duke Energy
Oliver, Mark	Duke Energy
Palmer, Miko	Duke Energy
Pool, Gretchen	SC ORS
Puryear, Leigh A	Duke Energy
Ralph, Karen Ann	Duke Energy
Ruhe, Mike	Duke Energy
Sandonato, Anthony	SC ORS
Shafeek-Horton, Timika	Duke Energy
Sharpe, Chris	Duke Energy
Shearer, Evan W.	Duke Energy
Shuler II, John R	Duke Energy
Spilman, Sam	Duke Energy
Taylor, Mindy H	Duke Energy
Thad Culley	Sunrun
Turner, Randy L	Duke Energy
Underwood, Lizzy	Duke Energy
Wells, Tiger	Duke Energy
Will Harlan	Sierra Club
Wurst Jr., James E	Duke Energy

South Carolina Grid Improvement Plan

ATTACHMENT E

2020 Status Report Virtual Forum – May 12, 2021

Agenda

- Welcome
  - Safety Moment
  - Meeting Logistics
- South Carolina GIP – 2020 Summary
- Project/Program Highlights
  - Self-Optimizing Grid
  - Targeted Undergrounding
  - DEC Integrated Volt/Var Control
  - DEP Long Duration Interruption – Cheraw Project
  - Transmission
  - Advanced Distribution Planning Tool
  - South Carolina Power Electronics Program
- Questions
- Climate Risk & Resiliency Study
- Continuation of GIP for 2022 and Beyond

Safety Moment

Spring is here and people are excited to get outdoors to plant trees, shrubs and flowers as well as begin outdoor construction projects.

But first, contractors, homeowners, business owners or anyone preparing for a digging project should make an important call to 811, the free, nationwide service “Call Before You Dig” hotline and ask that the underground utilities on the property be properly located and marked.

This action prevents damage to underground utilities, prevents personal injury and avoids electric and other utility outages along with costly repairs.

In 2019, the U.S. Common Ground Alliance reported approximately 532,000 excavation-related damage events in the U.S., an increase of 14 percent from 2018, the latest year for which figures are available. Estimated damages in 2019 total approximately $30 billion in direct and indirect losses.

811 website: https://call811.com

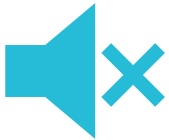
Meeting Logistics

This meeting will not be recorded by Duke Energy and we ask that attendees do not record as well.

The presentation will be distributed after this session and filed with the Commission.

For optimal viewing of the presentation, please maximize the window by clicking the ellipsis at top scrolling down and selecting “Full Screen.” To minimize, de-select “Full Screen.”

For technical difficulties, please use the chat feature to let us know if you are having challenges seeing or hearing anything. We will be monitoring those comments and will assist you with troubleshooting by chatting with you directly.



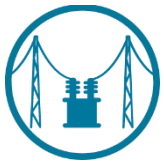
All attendees, apart from designated speakers, are muted to mitigate background noise disruptions.

Please submit questions through the Teams meeting chat. Speakers will address questions at the end of the presentation as time allows. If you have questions aside from today’s topic or if time does not allow us to answer today, we will follow up with you directly.

South Carolina GIP – 2020 Summary

Self-Optimizing Grid self-healing networks continued to prevent millions of customer minutes of interruptions in South Carolina.

A significant Long Duration Interruption project crossing the Pee Dee river was completed.



The Substation Flood Mitigation subprogram, which builds in protection of substations most vulnerable to flood damage, was completed in South Carolina.

The pandemic presented challenges for our execution teams in the form of limited resources, planned outage restrictions and supply chain interruptions.

South Carolina GIP – 2020 Summary

Capital Expenditures 2019 and 2020	DEC - SC	DEP - SC
Cumulative Target	$178,027,060	$70,080,782
Cumulative Actuals	$143,285,954	$67,206,707
Cumulative Variance	($34,741,106)	($2,874,075)
2019 Variance	$996,487	($1,384,760)
2020 Variance	($35,737,593)	($1,489,315)

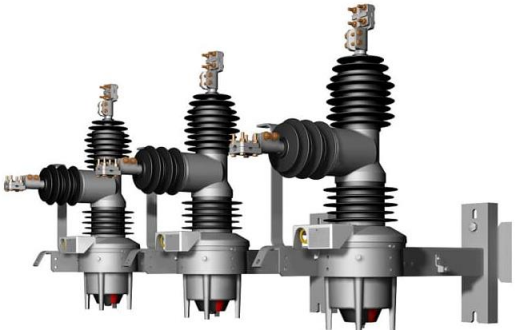
Self-Optimizing Grid Benefits

Self-Optimizing Grid (Inception-to-date as of 12/31/2020)	DEC	DEP
Successful Operations	100	104
Customer Interruptions Saved	76,742	74,264
Customer Minutes Interrupted Saved	16,967,369	13,700,378

- Tropical Storm Zeta (DEC) - 6 operations, 3,952 CI saved, and 1,927,300 CMI saved.

Self-Optimizing Grid Program

Self-Optimizing Grid (01/01/20 - 12/31/2020)	DEC	DEP
Number of circuits upgraded to SOG standard in 2020	13	20
Number of reclosers installed in 2020	21	38



Electronic Reclosers

Capacitor and Voltage Regulator Controls

Targeted Undergrounding Program

Targeted Undergrounding (01/01/20 – 12/31/20)	DEC	DEP
Miles Completed	4.89	2.95
Projects (Neighborhoods) Placed in Service	6	16
Total Number of Customers	444	384

- DEC has completed projects in Greenville and Spartanburg Counties.
- DEP has completed projects in Darlington, Florence, Marion, Sumter and Williamsburg Counties.

Targeted Undergrounding Project – Spartanburg, SC

Hampton Heights Neighborhood

DEC Integrated Volt Var Control (IVVC) Highlights

Substations

- 16 substations finalized all engineering activities
- 11 sites completed civil construction work
- 4 control house panels were installed
- 4 sites completed telecom circuits
- 2 load tap changers upgraded

Greenville Main Substation Site Visit

Circuits

- Drone flights were completed on 109 circuits
- 45 circuits completed GIS/mapping updates
- 102 regulator controls were upgraded
- 15 capacitor banks were installed
- 7 circuits finished all construction activities and are IVVC Ready
- Created processes for first of kind work for capacitor installs and voltage regulator control upgrades

CBC-8000
Capacitor Control

CL7 Regulator
Control

Capacitor with 3 Phase Sensing

DEP Long Duration Interruption Project - Cheraw

- Project relocated three feeders from the swamp by combining to one pole line closer to the road on 100’ steel poles on 5’ concrete base
- Now 21 steel poles have been installed, covering approx. 8,000 feet
- The Pee Dee River crossing is approximately 661 feet in length
- Improved service to 1,863 customers
- ~4 million customer minutes of interruption in previous three years
- Project completed on July 7, 2020

DEP Long Duration Interruption Project - Cheraw

Challenges of the Cheraw Project

Challenges of the Cheraw Project

Transmission Projects Highlights - DEP

Placed in Service During 2020

58
System Intelligence projects to improve remote grid visibility & control

40
Distribution feeder breaker circuit breaker upgrade projects covering 60+ breakers

16
Transmission Substation reliability upgrades including breaker and transformer upgrades

12
Hardening and Resiliency projects including substation flood prevention and animal outage prevention

Nichols, SC: Flooding during Hurricane Matthew (L) ; After flood wall and gate installation (R)

SC Benefit Highlights

- Nichols flood prevention wall completed
- Florence area Transmission 115kV and 230kV line segment rebuilds, improved PQ for C&I customers
- Substation breaker & transformer upgrades to reduce retail customer outages in Florence, Dillon, Marion, Mullins
- System Intelligence upgrades across footprint to improve outage response & restoration time, expand grid visibility

Transmission Projects Highlights - DEC

Placed in Service During 2020

30
System intelligence projects to improve remote grid visibility & control, outage response and restoration time

26
Hardening and Resiliency projects including Transmission circuit segment rebuilds and animal outage prevention upgrades

15
Transmission substation reliability upgrades including breaker and transformer upgrades

10
Hardening and Resiliency projects including substation flood prevention and animal outage prevention

Animal Resistant Substation Fence

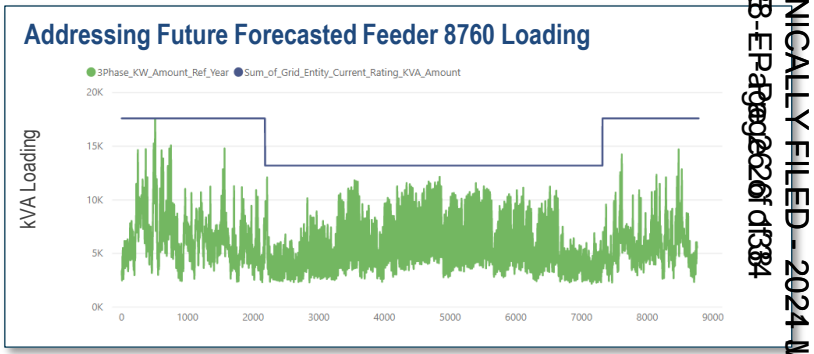
Digital Relay Protection & Control Panel

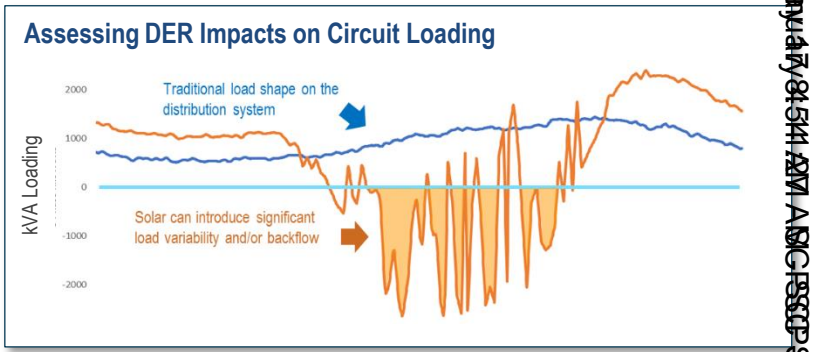
SC Benefit Highlights

- Prevention of animal-caused outages at 4 upstate substations (one of the leading Transmission causes of CMI) - Anderson, Belton, Augusta Rd, Eastover
- Transmission 44kV line segment rebuild in Campobello area; reduced retail customer outages & improved PQ for C&I customers
- Upgrade of 13 100kV breakers at Hodges Tie (Greenwood area) with state-of-the-art apparatus capable of quickly and effectively isolating faults and minimizing customer impacts of system disturbances

Advanced Distribution Planning (ADP) Tool

- Integrating sophisticated granular load forecasts
  - Current 3-5 year window evolving to 10 years
  - New capabilities for multiple planning scenarios
- New power flow resolution
  - From peak hour assessment to 8760 assessment
- Assessment of new solutions
  - DERs including battery storage systems
  - Capture benefits of D-sited options for G and T
- Integration and automation of new tools and data
  - New server based power flow models and integration
  - Supports more complex planning for a dynamic grid
  - Tools and processes will evolve as planning needs change





Advanced Distribution Planning (ADP) Tool

Hybrid Solution

- Combines power flow software with advanced analytics capabilities
- Capable of engineering DERs as a Load Violation Solutions (non-wires alternative)

Introducing Automation

- Reduced engineering time spent resolving modeling issues and performing circuit analyses
- Time-saving analytics for identifying mitigation solutions to accommodate higher levels of DER
- Reduced engineering time when evaluating DER as a non-wires alternative
- Analysis of more solution alternatives and consistency in investment decisions

ADP Toolset – Carolinas System

South Carolina Power Electronics Program

Overview

As the adoption of distributed energy resources (DER) (e.g., customer-owned solar and energy storage) reaches critical levels and microgrid technology matures, protective device technology must also advance to appropriately detect and respond to rapid voltage and power fluctuations that often accompany non-dispatchable resources such as solar.

Integrating advanced solid-state technologies like power electronics (i.e., static VAR compensators and other solid-state voltage support equipment), better equips the distribution system to manage power quality issues associated with increasing DER penetration.

The program is still in its early stages and current plans are small pre-scale deployments to validate capabilities and benefits.

Accomplishments

- Subject Matter Experts identified for technical guidance, conducting field studies, & circuit analyses
- Completed proof of concept deployments
- Use cases have been defined

Upcoming Activities

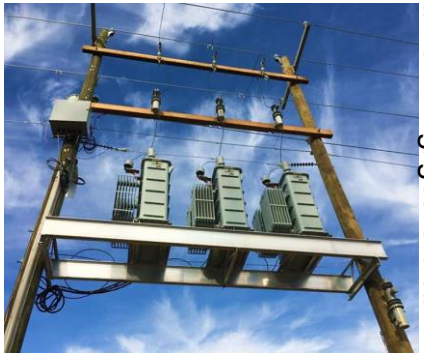
2021: Review & finalize deployment sites to put into production

2021: Work with vendor & distribution planning engineers to develop circuit evaluation methodologies

2021: Develop 12kV and 25kV design standards for medium voltage statcom devices

Issues and Risks

- 25KV medium voltage statcom solutions are still in production with an expected release Q3-Q4 2021
- Cellular signal strength will need to be conducted for each field site
- Future version of ADMS will provide ability to do real-time optimization of DVARs



Candidate Locations*
(Power Electronics for Volt/VAR)

Circuit	Circuit ID	Jurisdiction
Wrenn Ret 1208	02821208	DEC
Wrenn Ret 1209	02821209	DEC
Matrix Ret 2408*	02412408	DEC
CCSC 24KV*	T2825B01	DEP
Salem Crossroads*	T3060B02	DEP

***24KV Medium Voltage Solution not expected until Q3-Q4 202**

Questions

Please submit questions through the Teams meeting chat.

For questions not addressed during this virtual forum, Duke Energy will follow up directly with the individual who posed the question.

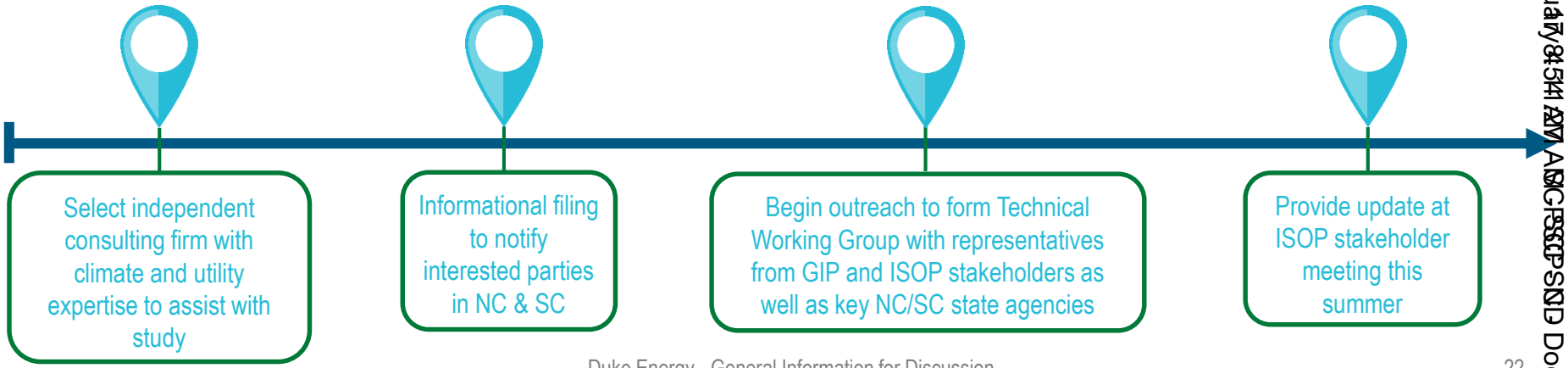
Climate Risk & Resiliency Study

Objective

Assess and prioritize climate-related impacts to Transmission & Distribution (T&D) system

Scope

T&D system within DEP & DEC service area for both NC & SC



Continuation of GIP for 2022 and Beyond

- Transmission and Distribution grid work and improvements will continue in South Carolina
- Continued engagement on next steps
  - Extended information sessions
  - Feedback from external stakeholders

ATTACHMENT E

BUILDING A **SMARTER** ENERGY FUTURE®

ATTACHMENT F

Duke Energy 2020 SC Grid Improvement Plan Virtual Forum Follow-up Survey

1. On a scale of 1-10, how well did this status report and forum enhance your understanding of the progress made in Duke Energy's South Carolina GIP through 2020?

0	1	2	3	4	5	6	7	8	9	10

Comments:

2. On a scale of 1-10, how satisfied are you with the opportunity to provide feedback and dialogue with Duke Energy during and after this virtual forum?

0	1	2	3	4	5	6	7	8	9	10

Comments:

3. On a scale of 1-10, how willing are you to participate in future engagements with Duke Energy focusing on the Grid Improvement Plan?

0	1	2	3	4	5	6	7	8	9	10

Comments:

4. Have you participated in previous virtual or in-person forums on this topic?
   Yes / No

5. Would you be open to providing additional input or data in advance of future virtual forums?
   Yes / No

ATTACHMENT F

6. Due to COVID-19, all recent stakeholder sessions have been virtual. To help plan for future sessions, when would you like to see a shift to in-person sessions?
    a. Fall 2021
    b. Early 2022
    c. Late 2022
    d. Stay with virtual sessions

7. What changes would you suggest for future meetings?

8. What GIP topics, programs or projects would you be interested in engaging on or hearing more about in future sessions?

9. For future extended information sessions, would you prefer brief single-topic forums or a longer multi-topic forum?

10. What grid-oriented projects/programs would you recommend Duke Energy investigate for future grid investments?

Samuel J. Wellborn
Associate General Counsel

Duke Energy
1201 Main Street
Suite 1180
Columbia, SC 29201

o: 803.988.7130
f: 803.988.7123

sam.wellborn@duke-energy.com

November 10, 2021

VIA ELECTRONIC FILING

The Honorable Jocelyn G. Boyd
Chief Clerk and Executive Director
Public Service Commission of South Carolina
101 Executive Center Drive, Suite 100
Columbia SC 29210

Re: Joint Petition of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC to Establish a Consolidated Informational Docket for Review and Consideration of Grid Improvement Plans (NDI Opened Pursuant to Commission Order No. 2020-533)
Docket No. ND-2020-28-E

Informational Update on Stakeholder Meetings Held October 26, 2021 and November 8, 2021

Dear Ms. Boyd:

On August 12, 2020, by Order 2020-533 in Docket No. 2019-381-E, the Commission approved Duke Energy Carolinas, LLC's and Duke Energy Progress, LLC's (collectively, the "Companies") joint request to establish an informational docket for review and consideration of its Grid Improvement Plan. As a result of that order, on August 14, 2020, the Commission opened the above-referenced NDI docket. Since that time the Companies have provided the Commission periodic updates related to its Grid Improvement Plan.

The Grid Improvement Plan is a decade-long plan of near- and long-term actions and investments designed to transform the power grid, making strategic, data-driven improvements to power a smart-thinking grid that is more reliable, more resilient, and built to meet the energy needs of customers today and into the future. The Companies have held a number of stakeholder meetings during the execution of the Grid Improvement Plan and will continue to do so. Most recently, the Companies held virtual forums on October 26, 2021 and November 8, 2021. On October 26, 2021, the Companies held a South Carolina Grid Improvement Plan Update virtual forum. During this session, subject matter experts discussed Grid Improvement Plan accomplishments to date, explained the continuation of the Grid Improvement Plan work, shared preliminary Grid Improvement Plan targets for 2022 to 2024, and sought stakeholders' continued engagement as targets are finalized. The Companies appreciate the robust discussions and stakeholder questions throughout the forum. Unfortunately, time ran out prior to covering all of the presentation materials and hearing stakeholder feedback. Therefore, the Companies' grid improvement team

hosted a second virtual forum session on November 8, 2021 to share information not covered on October 26 and to receive feedback and additional stakeholder questions.

Stakeholders who attended received a follow-up survey and those responses will better inform the Companies on stakeholders' engagement preferences and recommended projects or programs to be investigated for continued future grid investments.

The following attachments included with this update provide additional information on the October 26th and November 8th virtual forums:

- Attachment A: Invitations to Virtual Forums
- Attachment B: Stakeholder Distribution Lists
- Attachment C: List of Stakeholder Attendees
- Attachment D: Virtual Forum Pre-Event Survey
- Attachment E: South Carolina Grid Improvement Plan Update October 26 Virtual Forum Presentation
- Attachment F: South Carolina Grid Improvement Plan Update November 8 Virtual Forum Presentation
- Attachment G: Virtual Forum Follow-Up Survey

The Companies will continue to inform stakeholders, the Office of Regulatory Staff, and the Commission on developments in the Companies' Grid Improvement Plans.

Kind regards,

Sam Wellborn

Attachments

cc: (via email w/ attachments)

Counsel for Office of Regulatory Staff
Counsel for Department of Consumer Affairs
Counsel for Sierra Club
Counsel for Walmart, Inc.
Counsel for SELC on behalf of SC NAACP, SCCCL & Upstate Forever
Counsel for Nucor Steel-South Carolina
Counsel for CCEBA and Cypress Creek Renewables
Counsel for SCEUC
Counsel for Vote Solar
Counsel for CMC Recycling
Hasala Dharmawardena

ATTACHMENT A

Underwood, Lizzy

From: GIP engagement
Sent: Monday, Septem er 2 , 2021 :16 AM
Subject: ou are invited 10 26 Duke Energy Virtual Forum SC Grid Improvement Plan pdate

Good morning,

Please oin Duke Energy's Grid Improvement team at a virtual forum on ctober 2 , 2021 from 1:00-2:00 p.m. The purpose of the forum is to update interested stakeholders on SC GIP key accomplishments to date, discuss continued GIP work, listen to your feedback and respond to any questions that you may have.

If you wish to participate in the virtual forum, please register by ctober 20th using this link: Register here
Please also complete a pre-event survey at this link so the team can better collaborate with you: Survey here
Prior to ctober 2 th, you will receive an additional meeting notice with details for oining the Microsoft Teams meeting.

For assistance with registration, please email: Eventsupport@duke-energy.com. If you have any other questions, please feel free to reach out to: GIP-Engagement@duke-energy.com.

Thank you very much for your continued interest in Duke Energy's Grid Improvement Plan.

Sincerely,
Hilary S. Davidson
Director, Stakeholder Engagement
Duke Energy Corporation
980.373.5738
hilary.davidson@duke-energy.com

ATTACHMENT A

Underwood, Lizzy

From: GIP engagement
Sent: Thursday, to er 28, 2021 :0 PM
Subject: ou are invited 11 08 Duke Energy Virtual Forum SC Grid Improvement Plan pdate

Good afternoon,

Duke Energy hosted a forum on October 26th for interested stakeholders where subject matter experts discussed continued recent GIP work and shared draft targets for the ongoing GIP into 2022-2024. It was busy session, and the Company appreciated the robust discussions and stakeholder questions throughout the forum. Unfortunately, we ran out of time to cover some of the materials in the presentation and hear stakeholder feedback prior to wrapping up the session.

Duke Energy's Grid Improvement team would like to host another session to share Transmission program details not covered on October 26th and receive feedback or additional questions on the ongoing GIP into 2022-2024. Please join the team at a follow-up virtual forum on November 8, 2021 from 2:00-3:00pm.

If you wish to participate, please register by November 7th using this link: Register here!
Prior to November 8th, you will receive an e-mail with details for joining the Microsoft Teams meeting.

For assistance with registration, please email: Eventsupport@duke-energy.com. If you have any other questions, please feel free to reach out to: GIP-Engagement@duke-energy.com.

Thank you very much for your continued interest in Duke Energy's Grid Improvement Plan.

Melissa Chandler Murphy
Director, Stakeholder Engagement
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ATTACHMENT B

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ATTACHMENT B

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George	awn	george.yawn@resolutefp.com	Resolute Forest Products

ATTACHMENT B

November 8, 2021 Virtual Forum - External Distribution List

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Brandon	Bickley	bbickley@ors.sc.gov	SC ORS
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Megan	Chase	mchase@upstateforever.org	Upstate Forever
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ATTACHMENT B

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Omari	Thompson	othompson@ors.sc.gov	SC ORS
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ATTACHMENT C

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Ben	Garris	bgarris@ors.sc.gov	SC ORS
Bryan	Jacob	bryan@cleanenergy.org	Southern Alliance for Clean Energy (SACE)
Robert	Lawyer	rlawyer@ors.sc.gov	SC ORS
Eddy	Moore	eddym@scccl.org	Coastal Conservation League
Dave	Rogers	david.rogers@sierraclub.org	Sierra Club
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ATTACHMENT C

November 8, 2021 Virtual Forum - External Attendee List

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Stephanie	Eaton	seaton@spilmanlaw.com	Spilman Law (WalMart)
Andrew	Grieve	agrieve@pgrenewables.com	Pine Gate Renewables
Dave	Rogers	david.rogers@sierraclub.org	Sierra Club
Anthony	Sandonato	asandonato@ors.sc.gov	SC ORS
Adam	Stein	astein@pgrenewables.com	Pine Gate Renewables

ATTACHMENT D

South Carolina Grid Improvement Plan Update Virtual Forum

Pre-Event Survey

* Required

1. Did you attend the 2020 SC GIP Status Update Virtual Forum or review the filed information? *

   ◯ Yes

   ◯ No

2. What topics or programs would you like to hear more about in future virtual forums?

3. What type of information do you find most useful during virtual forums or presentations? *

4. Are you working with Duke Energy on any other stakeholder engagement initiatives in the Carolinas? *

- ◯ Yes
- ◯ No

5. Are you interested in continuing engagement with Duke Energy about our Grid Improvement Plan? *

- ◯ Yes
- ◯ No

ATTACHMENT D

6. What outcome(s) or benefit(s) of the Grid Improvement Plan do you value most?

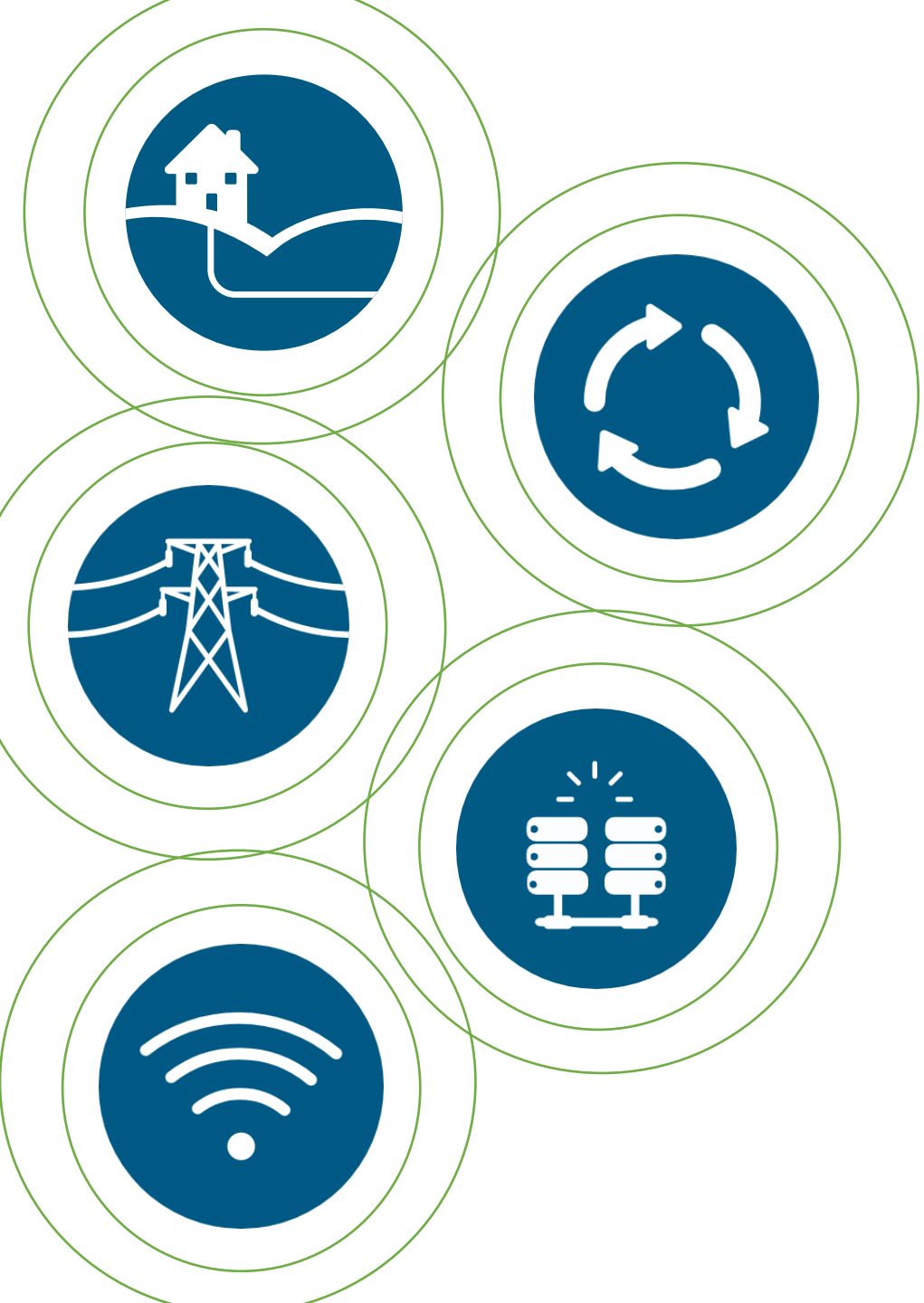
7. Name & Contact Information: *

ATTACHMENT E

The Virtual Forum will be starting shortly.

Thank you for joining us.

ATTACHMENT E

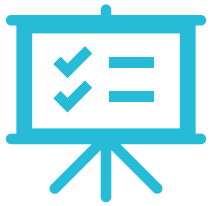


South Carolina Grid Improvement Plan 2022-2024 Update

October 26, 2021

Meeting Logistics

This meeting will not be recorded by Duke Energy, and we ask that attendees do not record as well.



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For optimal viewing of the presentation, please maximize the window by clicking the ellipsis at top, scrolling down and selecting “Full Screen.” To minimize, de-select “Full Screen.”

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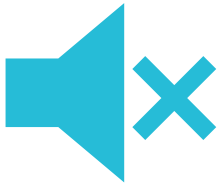


All attendees, apart from designated speakers, are muted to mitigate background noise disruptions.

Please submit questions through the Teams meeting chat. Speakers will address questions as time allows. If you have questions aside from today’s topic or if time does not allow us to answer today, we will follow up with you directly.

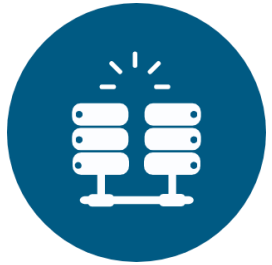
Key Accomplishments to Date

Justin Brown
Director, Planning & Regulatory Support

Key Accomplishments

Self-healing networks continue to prevent millions of customer minutes of interruption in SC, including 33.2 million minutes inception-to-date as of September 30, 2021.

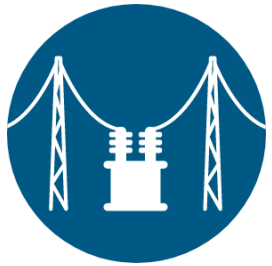
- To date, Duke Energy has installed self-healing technology to serve 8.7% of customers in DEC and 47.2% of customers in DEP in SC.
- The automated self-healing technologies have operated at a high success rate when called upon, at 100% and 97% for DEC and DEP YTD 2021, respectively.



Through September 2021, the **IVVC** program has installed 13% of the capacitors, installed 55% of the regulator controls, completed 6% of the substations and completed 17% of circuits.

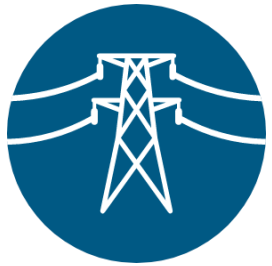
- The project is on track to begin testing completed substations in 2022 and automated control of distribution voltage starting in 2023 and ramping up to full implementation on all targeted substations by 2025.
- Although IVVC construction is not scheduled to be completed until 2023, the equipment is already providing increased operational awareness to distribution grid conditions.

Key Accomplishments



The **Substation Flood Mitigation** subprogram, which builds in protection of substations most vulnerable to flood damage, was completed in South Carolina.

- There has been an increase in extreme flooding events across the Southeast in the last decade, and meteorologists expect this trend to continue.
- The Carolinas have experienced at least four 500-year flood events since 2015.



Installations of intelligent communication equipment have been completed at 21 South Carolina substations (88 Carolinas system-wide) as part of the **Transmission System Intelligence** program.

- The data collected from digital relays and condition-based monitors helps better assess and optimize transmission asset health.
- The installation of transformational grid monitoring and control equipment will allow for faster analysis and response to events.
- Increased automation enables a dynamic self-healing and remotely operated grid that improves flexibility and reduces duration of outages.

Key Accomplishments

Long Duration Interruption projects improve the reliability for parts of the grid with high potential for extended outages as well as for high-impact customers like airports and hospitals. Notable completed projects to date include:

- Cheraw - Pee Dee River Crossing
- Moore to Woodruff Tie
- Greenville Health System Critical Care
- Eddy Rd to Panaroma Tie

The **Enterprise Communications** program addresses technology obsolescence, secures vulnerabilities and provides new workforce-enabling capabilities. A few program highlights include:

- Vehicle Area Network (VAN) Telematics portion of VAN project completed
- Mission Critical Transport – replacement and expansion of fiber
- Towers Shelters Power Supplies – replacement and expansion of communications towers as well as shelters and power supplies at tower locations
- Next Generation Cellular – replacement of 2G/3G modems

Key Accomplishments

Cyber Security improvements have been made in several programs, including:

- Through the completion of the Secure Access Device Management (SADM) project, Duke Energy is now able to better maintain passwords and retrieve fault files securely and remotely for thousands of SCADA controlled devices (i.e., regulators, capacitors, reclosers) in DEC and DEP.
- The Distribution Line Device Protection program completed the DEP Capacitor bank control upgrades in 2020 and the DEC recloser control changeouts in 2021. Future work will be required to continue upgrading line device controls.

The **Targeted Underground program** has converted more than 20 miles of outage prone parts of the system to underground to maximize the number of outages eliminated and restore service more quickly and cost effectively to all customers in SC. Projects occurred in Chesterfield, Clarendon, Darlington, Dillon, Florence, Greenville, Lee, Marion, Spartanburg, Sumter, and Williamsburg counties.

Looking Ahead

Justin Brown
Director, Planning & Regulatory Support

Emily Henson
Vice President, Customer Delivery Strategy & Transformation

Background

Identified need for GIP work to address Megatrends and benefit customers

Held stakeholder engagement sessions to develop and present GIP

Filed Annual Status Reports for 2019 and 2020

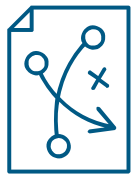
Evaluating 2022 – 2024 GIP targets

The grid strategy addresses seven megatrends

Megatrend	Description	Supporting information
Impact of weather events	Increasing intensity in the number, severity and impact of weather events is leading to more outages for customers	South Carolina was impacted by a record of **10** "Billion-dollar storms" in 2020 (most in South Carolina's history)[2]
Technology advancements - renewables and DERs	Renewables and DERs are becoming a significant capacity resource on the grid and are expected to grow rapidly over the next few decades	Installed solar capacity in South Carolina will increase **17%** and reach **~4.1 GW** by 2025[1]
Threats to grid infrastructure	Purposeful threats to the electric grid are on the rise, including physical and cyber threats (e.g., ransomware, theft)	Ransomware in the US increased **62%** in 2021[3], and utility cybersecurity spending is expected to double by the end of the decade[4]
Environmental trends	Private and public sector commitments to clean energy escalates customers' desire for safe and reliable DER access	**60%** of Fortune 500 companies (incl. companies in SC such as BMW, Michelin, etc.) have set carbon emissions goals[5]
Grid improvement	Grid improvement technology has advanced over the last decade, giving utilities alternatives to traditional grid infrastructure options	Advancements in tech provide new solutions; U.S. market for smart grid IT and analytics software to grow from **$3B to $6B** (2019 to 2028)[6]
Concentrated population growth	Population growth is concentrating in urban and suburban areas	Three South Carolina cities are among the **20** fastest growing nationally[7]
Customer expectations	Customers increasingly want to save money, reasonably reduce outages, and safely access clean energy options	Reliability and affordability are the most common feedback topics for Carolina's customers in a recent survey[8]

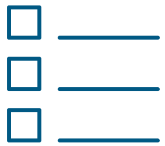
Source: [1]SEIA 2021; [2]NOAA 2021, [3]Sonic Wall 2021, [4]Guidehouse 2019, [5]World Wildlife Fund 2021; [6]U.S. DOE 2018, [7]US News & World Report, [8]Duke energy CXM 2020 survey

Overview of the maturing grid strategy



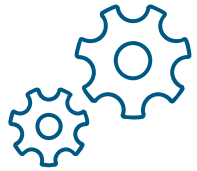
Grid objectives

- Address the implications on grid requirements and customer expectations from the Megatrends by **balancing three objectives**:
  - **Resilient** to mitigate customer costs and outages from severe weather
  - **DER enablement** to give customers safe and reliable access to DER options
  - **Equity** to ensure affordable bills and distribution of benefits across customers



Capability investment

- Identify **general grid characteristics required** to achieve these objectives and address customer needs
- Deliver the capabilities through grid programs **consistent with those in the GIP**



Execution approach

- Continue evolving the use of **data and analytics to identify when and where to invest** based on local needs (e.g., forecasting capacity needs using ADP and Morecast tools)
- Maximize customer benefit by **transitioning from a programmatic to a project-based execution approach** around our communities while building a local grid capable of 2-way power flow

Grid characteristics and associated customer benefits

Grid characteristics	Customer benefits	Example investment programs
Reliability	• Minimizes customer impact from increased storm activity and severity, reducing the risk of outages and subsequent storm restoration costs • Ensures the reliability that's critical to provide customers access and "up time" to DERs • Reduction in power interruptions from vegetation, vehicle collisions, wildlife, etc.	• Distribution Transformer Retrofit • Substation Flood Mitigation • Targeted Undergrounding • Self-Optimizing Grid
Capacity	• Equips circuits with the necessary capacity to serve increasing load in areas of concentrated growth • Improves grid flexibility by further enabling load shifting capabilities across circuits • Ensures circuits have sufficient capacity to support 2-way power flow to safely integrate DERs and electrification	• Self-Optimizing Grid
Communication & Automation	• Increased ability to detect faults and reroute power to reduce customer impact (CMI) from outages • Equips grid operators with the necessary tools to manage demand fluctuations from DERs, reducing outages from renewable intermittencies • Increases access and adoption of innovative customer programs by enabling two-way information exchange	• Self-Optimizing Grid • Vehicle Area Network (VAN) • Distribution Automation • DER Dispatch Enterprise Tool
Voltage	• Maintains voltage levels within safe operational limits to ensure power quality and reduce the intermittency and fluctuations caused by DERs	• Integrated Volt/VAR control (IVVC) • Power electronics for Volt/VAR control

Transforming Grid Improvement Plan Execution

Optimizing around our substations and communities reflects our continued focus on grid improvement in a manner that maximizes resources while minimizing cost and customer impact.

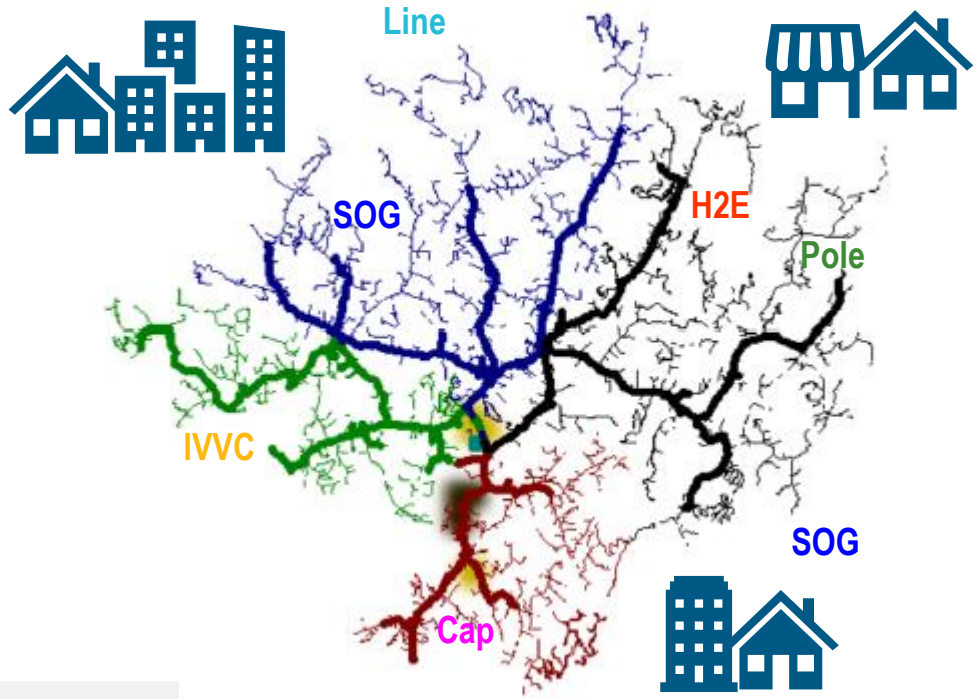
- Assets like conductor, automatic protective devices, voltage controllers, and power sensors will be installed using a coordinated approach across an entire substation, creating reliability and resiliency benefits across an entire geographic area
- We have evolved into executing GIP substation by substation versus programmatic execution
- The approach combines the installation of programmatic work with planned maintenance investments while tracking project costs independently resulting in:
  - less interruption for our customers and communities we serve
  - addressing the megatrends
  - efficiencies in the use of resources, including high demand labor and materials

Transforming Grid Execution

Traditional Model
Programmatic

- ❑ Self-Optimizing Grid
- ❑ Voltage Regulation
- ❑ Substation & Circuit Capacity
- ❑ Pole / Deteriorated Conductor
- ❑ Sectionalization
- ❑ Line Relocation
- ❑ Underground Work
- ❑ Transformer Retrofit

Substation
Project



Project Lifecycle – Plan, Design, Build

Benefits:

Sustainably Integrate DERs ● Operational Efficiency ● Improved Resilience ● Community and Customer Engagement

Self-Optimizing Grid and Targeted Undergrounding

Kenneth McCraw
Director, Customer Delivery Carolinas

Self-Optimizing Grid

The **Self-Optimizing Grid** is transforming our radial distribution system to an automated distribution network that provides:

- ***Connectivity*** with automated devices between our circuits.
- ***Capacity*** on our circuits and substation banks to allow dynamic switching. Can't back-feed without capacity.
- **Segmentation** such that our circuits have smaller line segments, thus reducing the number of customers affected by outages.
- ***Automated Control*** to manage our grid. This is the automated head-end system, plus SCADA enabled field devices.

DEC

10%

Expected % of SC customers to be served by automation by end of 2021

20-30%

Expected % of SC customers to be served by automation by end of 2024

DEP

47%

Expected % of SC customers to be served by automation by end of 2021

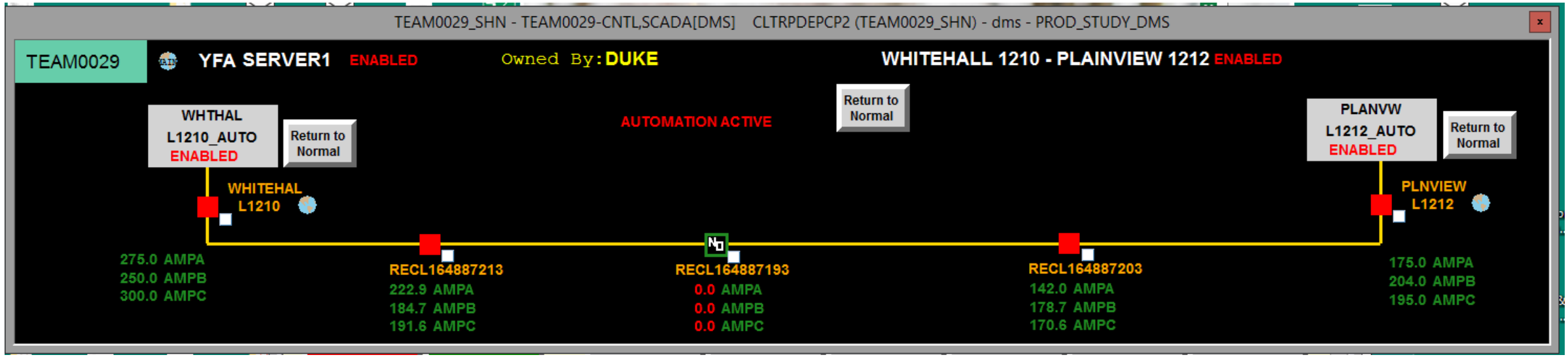
50-60%

Expected % of SC customers to be served by automation by end of 2024

ANDERSON, SC

Self-Optimizing Grid

DCC OPERATOR VIEW: ANDERSON, SC



Targeted Undergrounding (TUG)

The TUG program strategically identified Duke Energy's most outage prone overhead power line sections and relocates them underground to reduce the number of outages experienced by customers. When these segments of lines fail, they cause problems for Duke Energy's customers directly served by them as well as customers upstream. Lines targeted to be moved underground are typically the most resource-intensive parts of the grid to repair after a major storm, requiring manual time-consuming restoration.

Candidate Projects	Utility	County
Colonial Avenue	DEC	Lancaster
Phifer Street	DEC	York
Greelyville	DEP	Williamsburg
Brookland Drive	DEP	Sumter

Criteria for consideration in the selection of targeted communities include:

- Performance of overhead lines
- Age of assets
- Service location (e.g., lines located in backyard where accessibility is limited)
- Vegetation impacts (e.g., heavily vegetated and often costly and difficult to trim)

Integrated Volt-Var Control (IVVC)

Leslie Clark
Project Director, Customer Delivery Carolinas

Integrated Volt-Var Control (IVVC)

SUBSTATIONS

100%	53%	23%	6%
Site visits and scope documents	Engineering packages	Civil construction	IVVC Ready substations

CIRCUITS

41%	17%
Drone flights and GIS corrections	IVVC Ready circuits

BENEFITS and OUTCOMES

- Data validation of first substation and circuits ongoing to Knollwood Retail substation (west of Spartanburg) in preparation for testing in 2022
- IT systems are in development for consistent reporting of load reduction achieved

LAURENS, SC
Circuit Regulator Control Installation

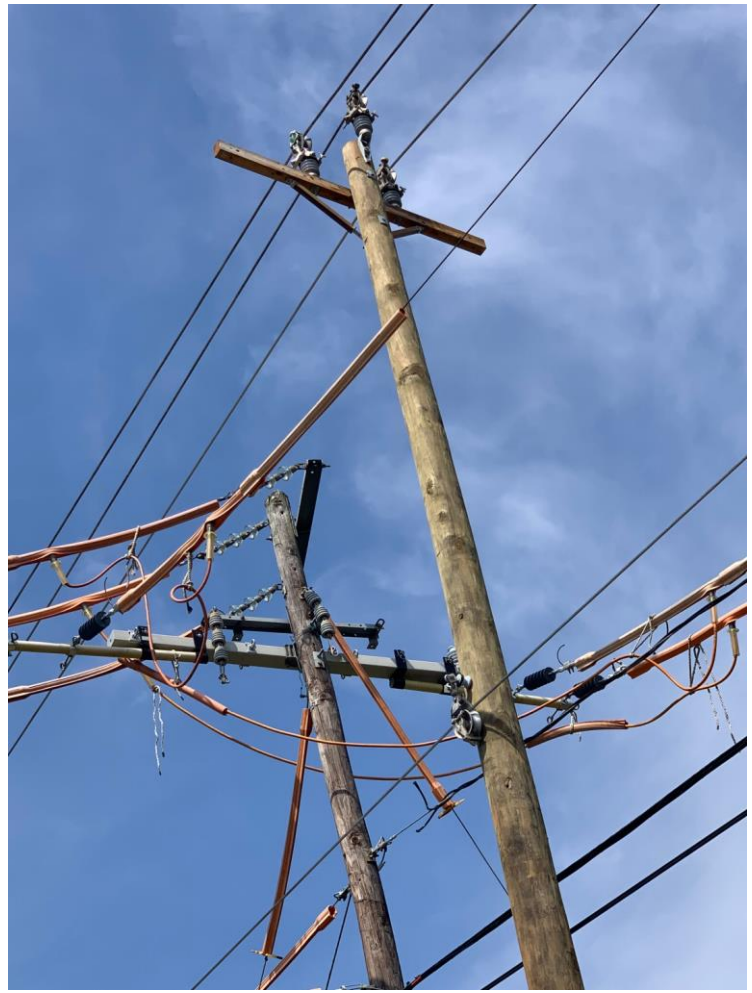
Long Duration Interruptions / High Impact Sites

Sam Spilman
Director, Customer Delivery Carolinas

Long Duration Interruptions / High Impact Sites

The LDI/HIS program is designed to improve the reliability in parts of the grid where the duration of potential outages is expected to be much higher than average. Focus areas for this program are radial feeds to entire communities or large groups of customers as well as inaccessible line segments (i.e., off road, swamps, mountain gorges, extreme terrain, etc.).

Candidate Projects	Utility	County
GSP Airport	DEC	Spartanburg
Apalache Feeder	DEC	Spartanburg
Latta Feeder	DEP	Dillon
Lake View Feeder	DEP	Dillon
McColl Feeder	DEP	Marlboro



YORK/SHARON GROVE FEEDER TIE

Long Duration Interruptions / High Impact Sites

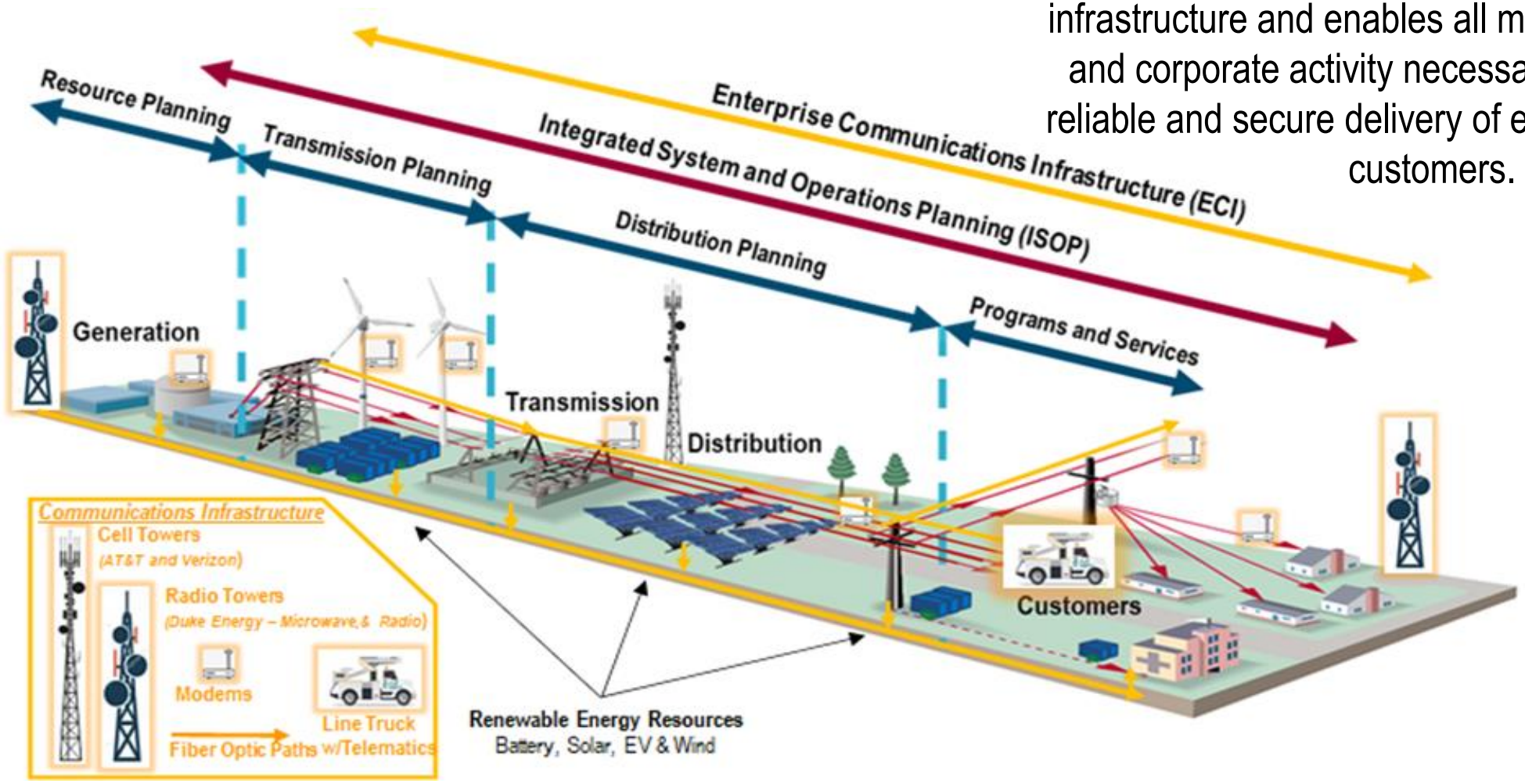
LYNCHES RIVER CROSSING near JOHNSONVILLE, SC

Enterprise Communications

Chris Crane
Director, Customer Delivery IT Planning & Governance

Enterprise Communications

The Enterprise Communications program is a foundational element of today's modern grid infrastructure and enables all means of operational and corporate activity necessary to ensure safe, reliable and secure delivery of electric power to our customers.

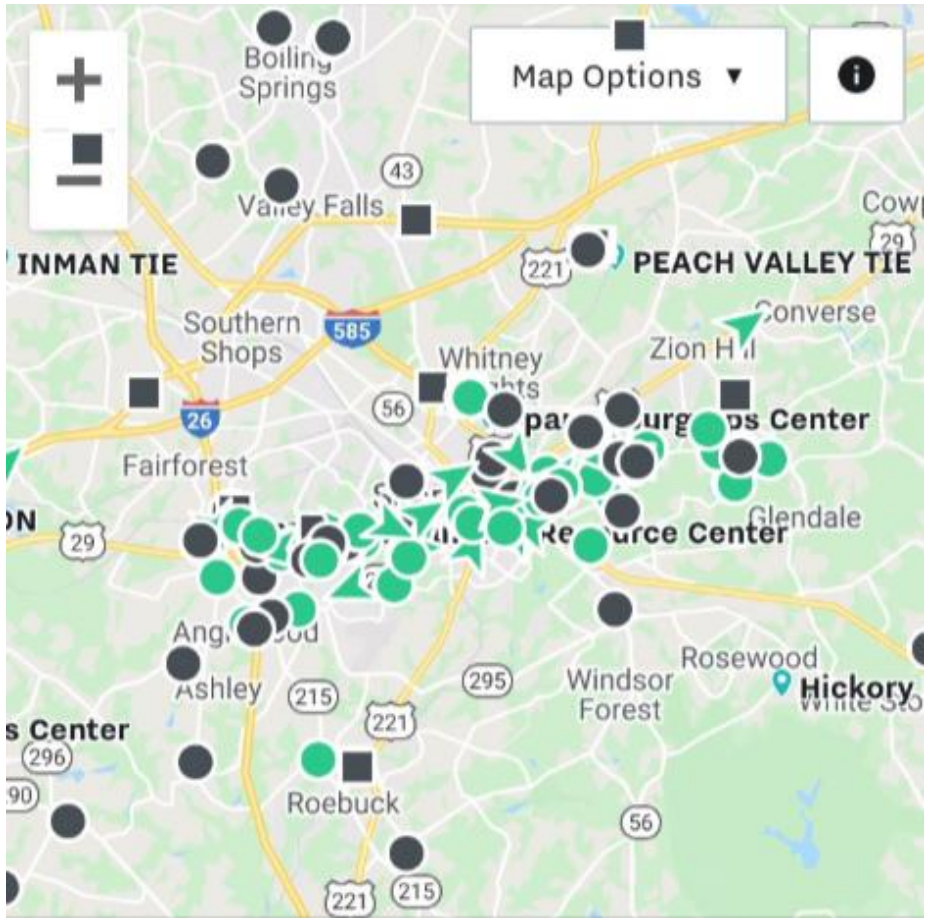


Enterprise Communications

Vehicle Area Network (VAN) Telematics

technology extends network connectivity to Duke Energy vehicles for the collection of vehicle telemetry data.

- Used in daily business tasks as well as staging and dispatching after major weather events
- Provides better information for restoration crews to serve the Carolinas



SPARTANBURG, SC

February 2020

Tornado Restoration Response

Energy Storage

Gray Tompson
Business Development Manager, Energy Storage Development

Energy Storage

Reliability and Resiliency focus

Target areas constrained by geography and/or service territory assignment

Rural, miles-wide pockets contain community-critical buildings and equipment

GIP energy storage sites are very similar in arrangement and aesthetic

Located in both DEP and DEC

Energy Storage

4 Projects, on average 6.5 MW and 13.5 MWh

Microgrids containing **400-700** metered customers

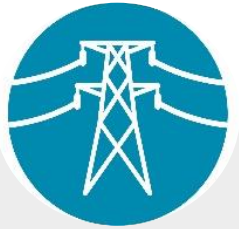
"First of a kind" for Duke Energy in South Carolina

Projected completion **Q3 2024 – Q3 2025**

Transmission Programs

Amy Howe
Director, Transmission Asset Management

Core Transmission Programs



TRANSMISSION MODERNIZATION

- Hardening & Resiliency programs for substations and lines
- Physical and cyber security
- System intelligence

Hardening/Resiliency – Substations

Increased operational flexibility, adaptability, and speed during and following outage events. Ensures grid will support reliable and safe access to distributed energy resources.

Hardening/Resiliency – Transmission Lines

Transmission Lines designed for severe weather and increased automation across the grid; Improved operational flexibility, adaptability, and speed during and following outage events. Ensures grid will support reliable and safe access to distributed energy resources and large-scale solar facilities.

Physical/Cyber Security

Improved guards protecting the overall security of the transmission system. Leveraging security measures to detect, defend, and mitigate threats and for rapid recovery should an event occur.

System Intelligence

A smart transmission system allows for faster, more intelligent analysis and response to events and a platform for asset health management. Modernizes transmission system device communication capabilities that enables better protection and monitoring of system equipment and remote capabilities.

Transmission Substation Hardening & Resiliency

Candidate Projects	Utility	County
East Greenville Switching Station	DEC	Greenville
Pickens Tie	DEC	Pickens
Robinson Steam Electric Plant (SEP)	DEP	Darlington
Sumter 230kV	DEP	Sumter

Duke Energy is moving away from transmission level oil breakers to modern circuit breaker technology.

Retired 230/115kV Transformer at Robinson SEP

New 230/115kV Transformer at Robinson SEP

Transmission Oil Filled Breaker

Transmission Gas Breaker with Condition Monitoring

Transmission Line Hardening & Resiliency

Candidate Projects	Utility	County
Campobello & Sigsbee A&B 44 kV Line Rebuilds	DEC	Spartanburg
Belfast 44 kV Line Rebuild	DEC	Laurens/ Newberry
Liberty 44kV Line Rebuild	DEC	Pickens

Shoals 44kV 75' Wood Structure Before Rebuild

Shoals 44kV 90' Steel Structure After Rebuild

Transmission Programs – System Intelligence

Candidate Projects	Utility	County
Reedy River Tie	DEC	Greenville
Wylie Switching Station	DEC	York

Condition Based Monitoring Components feeding HRM Platform

Electromechanical to Digital Relays

2022-2024 Targets and Next Steps

Justin Brown
Director, Planning & Regulatory Support

GIP Programs/Projects Status

COMPLETED
(expected by 12/31/2021)

Distribution Transformer Retrofit (DEC)
Secure Access Data Management (SADM)
Substation Flood Mitigation

IN-FLIGHT

Self-Optimizing Grid
Integrated Volt/VAR Control (IVVC)
Transmission H&R
Targeted Undergrounding
Energy Storage
Distribution Transformer Retrofit (DEP)
Long Duration Interruptions/High Impact Sites
T-Transformer Bank Replacement
Oil Breaker Replacements
Enterprise Communications
Distribution Automation
Transmission System Intelligence
Enterprise Applications
Integrated Systems Operations Planning
DER Dispatch Tool
Electric Transportation
Power Electronics for Volt/VAR Control
Physical & Cyber Security

NEW

SC GIP 2022-2024 Draft Targets Summary

Proposed Capital Expenditures by Program*	2022	2023-2024	Total 2022-2024
Self-Optimizing Grid	$53.1M	$85.0 – 103.9M	$138.1 - 157.0M
Distribution H&R – Flood Hardening	$2.7M	$10.7 – 13.0M	$13.3 - 15.7M
Distribution Transformer Retrofit	$2.9M	-	$2.9M
Integrated Volt/VAR Control	$44.0M	$27.2 – 33.2M	$71.2 – 77.2M
Transmission H&R	$25.0M	$40.6 – 49.6M	$65.6 – 74.6M
Transmission Transformer Bank Replacement	$12.0M	$15.8 – 19.3M	$27.8 – 31.3M
Transmission System Intelligence	$10.0M	$8.6 – 10.5M	$18.6 – 20.5M
Oil Breaker Replacement	$24.1M	$56.1 – 68.5M	$80.2 – 92.6M
Targeted Undergrounding	$14.0M	$27.5 – 33.6M	$41.5 – 47.6M
Energy Storage	$0.1M	$29.3 – 35.8M	$29.4 – 35.9M
Long Duration Interruptions / High Impact Sites	$0.8M	$23.0 – 28.2M	$23.8 – 28.9M
Enterprise Communications	$22.3M	$33.7 – 41.2M	$56.0 – 63.5M
Distribution Automation	$20.4M	$37.6 – 45.9M	$58.0 – 66.4M
Enterprise Applications	$1.1M	$1.3 – 1.6M	$2.4 – 2.7M
ISOP	$1.9M	$2.9 – 3.5M	$4.7 – 5.4M
DER Dispatch Tool	$0.9M	$1.4 – 1.7M	$2.3 – 2.6M
Power Electronics for Volt/VAR	$0.8M	$3.7 – 4.6M	$4.6 – 5.4M
Physical and Cyber Security	$4.4M	$4.9 – 6.0M	$9.3 – 10.4M
Total	**$240.5M**	**$409.1 – 500.1M**	**$649.6 – 740.5M**

*The above values are the best-known estimates as of the time of this presentation.

Next Steps

- Transmission and Distribution grid work and improvements will continue in South Carolina

- This presentation will be filed in Docket No. ND-2020-28-E and attendees will receive a link when available

- Continued engagement on next steps
  - Feedback from external stakeholders from survey
    - Collaboration sessions as requested
    - Direct follow up with stakeholders on survey responses if applicable
  - GIP-engagement@duke-energy.com can be used to connect with us on GIP matters

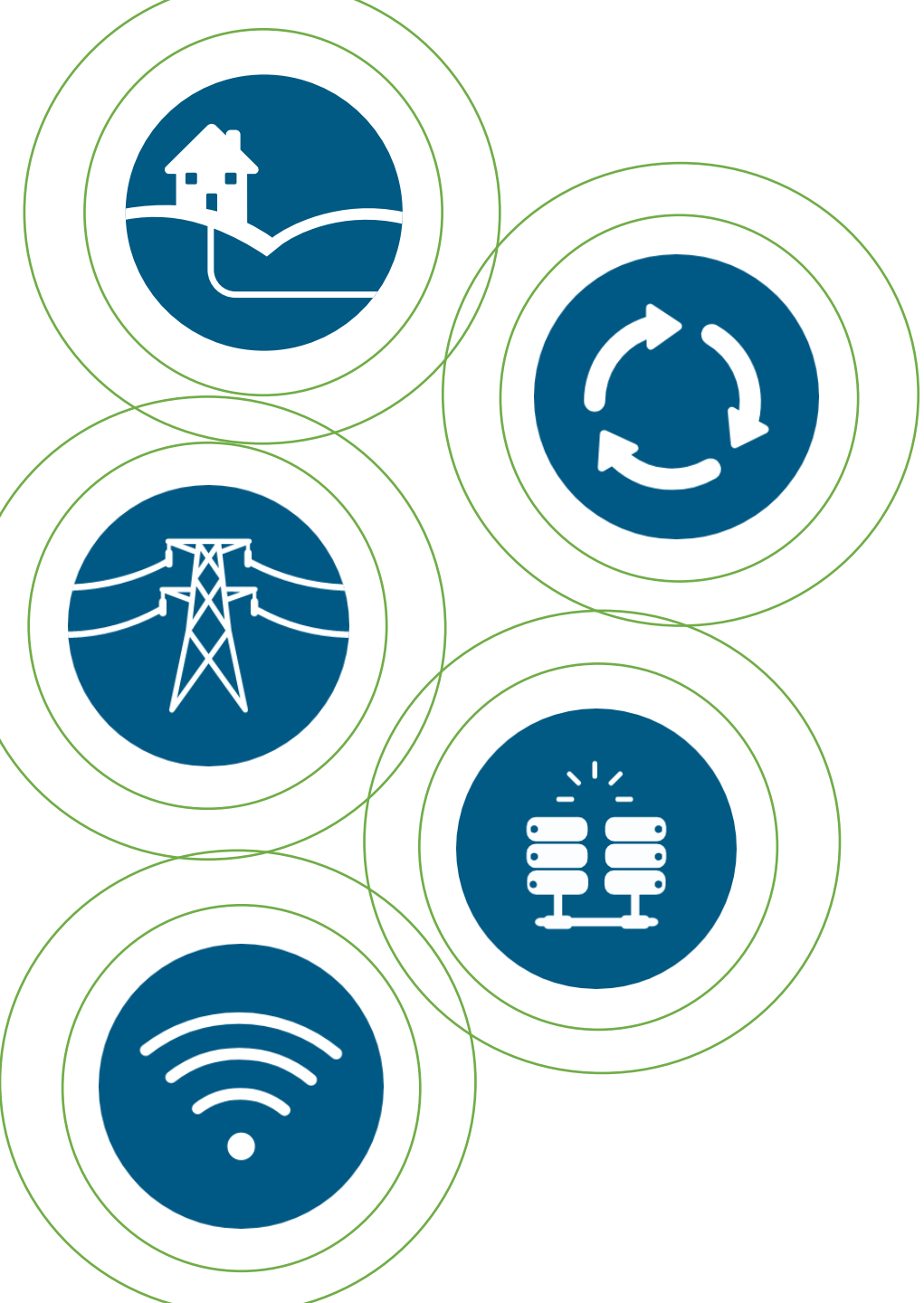
ATTACHMENT E

ATTACHMENT F

The Virtual Forum will be starting shortly.

Thank you for joining us.

ATTACHMENT F



South Carolina Grid Improvement Plan 2022-2024 Update

November 8, 2021

Meeting Logistics

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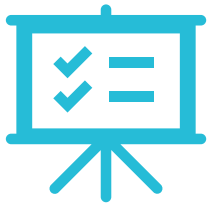

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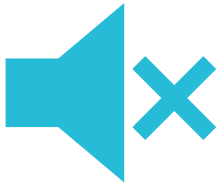

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Agenda

TOPIC	SPEAKER
Recap of October 26th Virtual Forum	Justin Brown
Transmission Programs	Amy Howe
Preliminary 2022-2024 Targets and Q&A	Justin Brown

Recap of October 26th Virtual Forum

Justin Brown
Director, Planning & Regulatory Support

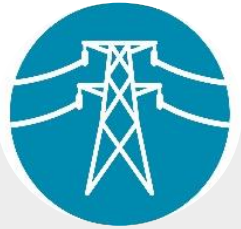
October 26th Virtual Forum Topics and Speakers

TOPIC	SPEAKER
Key Accomplishments to Date	Justin Brown
Looking Ahead – Megatrends & the Maturing Grid Strategy	Justin Brown & Emily Henson
Self-Optimizing Grid & Targeted Undergrounding	Kenneth McCraw
Integrated Volt/VAR Control (IVVC)	Leslie Clark
Long Duration Interruptions/High Impact Sites	Sam Spilman
Enterprise Communications	Chris Crane
Energy Storage	Gray Tompson
Transmission Programs	Amy Howe
Preliminary 2022-2024 Targets & Next Steps	Justin Brown

Transmission Programs

Amy Howe
Director, Transmission Asset Management

Core Transmission Programs



TRANSMISSION MODERNIZATION

- Hardening & Resiliency programs for substations and lines
- Physical and cyber security
- System intelligence

Hardening/Resiliency – Substations

Increased operational flexibility, adaptability, and speed during and following outage events. Ensures grid will support reliable and safe access to distributed energy resources.

Hardening/Resiliency – Transmission Lines

Transmission Lines designed for severe weather and increased automation across the grid; Improved operational flexibility, adaptability, and speed during and following outage events. Ensures grid will support reliable and safe access to distributed energy resources and large-scale solar facilities.

Physical/Cyber Security

Improved guards protecting the overall security of the transmission system. Leveraging security measures to detect, defend, and mitigate threats and for rapid recovery should an event occur.

System Intelligence

A smart transmission system allows for faster, more intelligent analysis and response to events and a platform for asset health management. Modernizes transmission system device communication capabilities that enables better protection and monitoring of system equipment and remote capabilities.

Transmission Substation Hardening & Resiliency

Candidate Projects	Utility	County
East Greenville Switching Station	DEC	Greenville
Pickens Tie	DEC	Pickens
Robinson Steam Electric Plant (SEP)	DEP	Darlington
Sumter 230kV	DEP	Sumter

Duke Energy is moving away from transmission level oil breakers to modern circuit breaker technology.

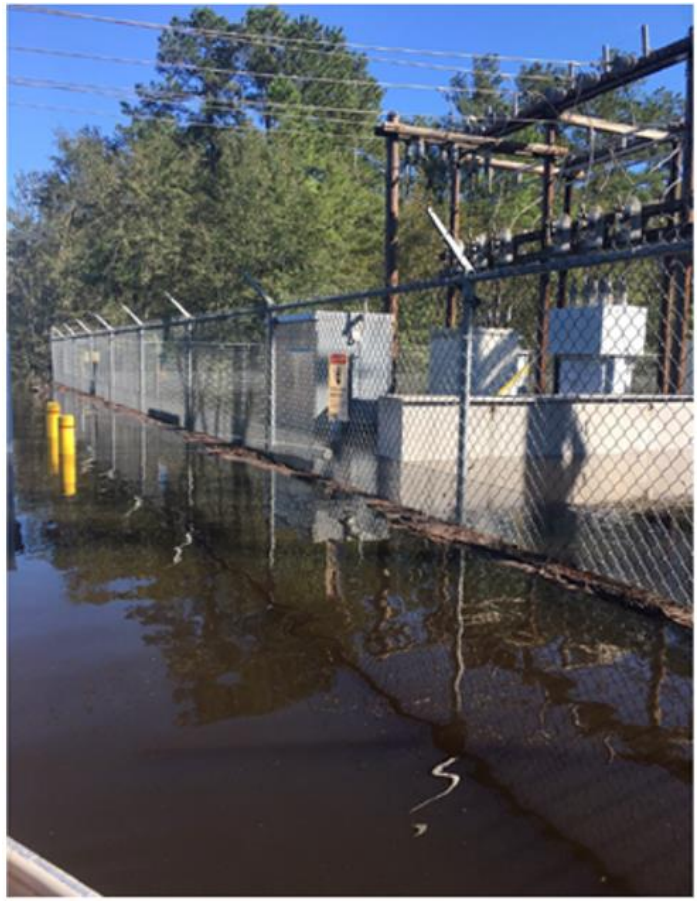
Retired 230/115 kV Transformer at Robinson SEP

New 230/115 kV Transformer at Robinson SEP

Transmission Oil Filled Breaker

Transmission Gas Breaker with Condition Monitoring

Nichols Substation – Nichols, SC



FLOODING DURING HURRICANE MATTHEW

AFTER FLOOD WALL & GATE INSTALLATION

4

Number of 500-year flood events the Carolinas have experienced since 2015

18

Depth of flood wall below ground (in feet)

8-9

Height of flood wall above ground (in feet)

Transmission Line Hardening & Resiliency

Candidate Projects	Utility	County
Campobello & Sigsbee A&B 44-kV Line Rebuilds	DEC	Spartanburg
Belfast 44-kV Line Rebuild	DEC	Laurens/ Newberry
Liberty 44-kV Line Rebuild	DEC	Pickens

Shoals 44-kV 75' Wood Structure Before Rebuild

Shoals 44-kV 90' Steel Structure After Rebuild

Transmission Programs – System Intelligence

Candidate Projects	Utility	County
Reedy River Tie	DEC	Greenville
Wylie Switching Station	DEC	York

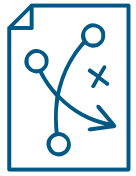
Condition-based Monitoring Components feeding HRM Platform

Electromechanical to Digital Relays

2022-2024 Targets and Next Steps

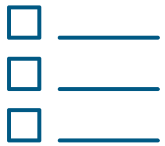
Justin Brown
Director, Planning & Regulatory Support

Overview of the maturing grid strategy



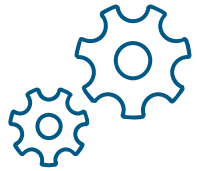
Grid objectives

- Address the implications on grid requirements and customer expectations from the Megatrends by **balancing three objectives**:
  - **Resilient** to mitigate customer costs and outages from severe weather
  - **Distributed Energy Resource (DER) enablement** to give customers safe and reliable access to DER options
  - **Equity** to help ensure affordable bills and distribution of benefits across customers



Capability investment

- Identify **general grid characteristics required** to achieve these objectives and address customer needs
- Deliver the capabilities through grid programs **consistent with those in the GIP**



Execution approach

- Continue evolving the use of **data and analytics to identify when and where to invest** based on local needs (e.g., forecasting capacity needs using ADP and Morecast tools)
- Maximize customer benefit by **transitioning from a programmatic to a project-based execution approach** around our communities while building a local grid capable of 2-way power flow

GIP Programs/Projects Status

COMPLETED
(expected by 12/31/2021)

Distribution Transformer Retrofit (DEC)
Secure Access Data Management (SADM)
Substation Flood Mitigation

IN-FLIGHT

Self-Optimizing Grid
Integrated Volt/VAR Control (IVVC)
Transmission H&R
Targeted Undergrounding
Energy Storage
Distribution Transformer Retrofit (DEP)
Long Duration Interruptions/High Impact Sites
T-Transformer Bank Replacement
Oil Breaker Replacements
Enterprise Communications
Distribution Automation
Transmission System Intelligence
Enterprise Applications
Integrated Systems Operations Planning
DER Dispatch Tool
Electric Transportation
Power Electronics for Volt/VAR Control
Physical & Cyber Security

NEW

SC GIP 2022-2024 Draft Targets Summary

Proposed Capital Expenditures by Program*	2022	2023-2024	Total 2022-2024
Self-Optimizing Grid	$53.1M	$85.0 – 103.9M	$138.1 - 157.0M
Distribution H&R – Flood Hardening	$2.7M	$10.7 – 13.0M	$13.3 - 15.7M
Distribution Transformer Retrofit	$2.9M	-	$2.9M
Integrated Volt/VAR Control	$44.0M	$27.2 – 33.2M	$71.2 – 77.2M
Transmission H&R	$25.0M	$40.6 – 49.6M	$65.6 – 74.6M
Transmission Transformer Bank Replacement	$12.0M	$15.8 – 19.3M	$27.8 – 31.3M
Transmission System Intelligence	$10.0M	$8.6 – 10.5M	$18.6 – 20.5M
Oil Breaker Replacement	$24.1M	$56.1 – 68.5M	$80.2 – 92.6M
Targeted Undergrounding	$14.0M	$27.5 – 33.6M	$41.5 – 47.6M
Energy Storage	$0.1M	$29.3 – 35.8M	$29.4 – 35.9M
Long Duration Interruptions / High Impact Sites	$0.8M	$23.0 – 28.2M	$23.8 – 28.9M
Enterprise Communications	$22.3M	$33.7 – 41.2M	$56.0 – 63.5M
Distribution Automation	$20.4M	$37.6 – 45.9M	$58.0 – 66.4M
Enterprise Applications	$1.1M	$1.3 – 1.6M	$2.4 – 2.7M
ISOP	$1.9M	$2.9 – 3.5M	$4.7 – 5.4M
DER Dispatch Tool	$0.9M	$1.4 – 1.7M	$2.3 – 2.6M
Power Electronics for Volt/VAR	$0.8M	$3.7 – 4.6M	$4.6 – 5.4M
Physical and Cyber Security	$4.4M	$4.9 – 6.0M	$9.3 – 10.4M
Total	**$240.5M**	**$409.1 – 500.1M**	**$649.6 – 740.5M**

*The above values are the best-known estimates as of the time of this presentation.

Next Steps

- Transmission and Distribution grid work and improvements will continue in South Carolina

- This presentation will be filed in Docket No. ND-2020-28-E and attendees will receive a link when available

- Continued engagement on next steps
  - Feedback from external stakeholders from survey
    - Collaboration sessions as requested
    - Direct follow up with stakeholders on survey responses if applicable
  - GIP-engagement@duke-energy.com can be used to connect with us on GIP matters

ATTACHMENT F

ATTACHMENT G

South Carolina Grid Improvement Plan Update Virtual Forum

Post-Event Survey

* Required

1. Please rate the following statement using the scale provided with 1 star = Strongly Disagree to 5 stars = Strongly Agree:
   The Virtual Forum was helpful in enhancing my understanding of Duke Energy's Grid Improvement Plan (GIP).
   *

☆ ☆ ☆ ☆ ☆

2. Please rate the following statement using the scale provided with 1 star = Strongly Disagree to 5 stars = Strongly Agree:
   I am satisfied with the opportunity to provide feedback to and engage in dialogue with Duke Energy.
   *

☆ ☆ ☆ ☆ ☆

3. Please rate the following statement using the scale provided with 1 star = Strongly Disagree to 5 stars = Strongly Agree:
   This stakeholder engagement has been effective for me.
   *

☆ ☆ ☆ ☆ ☆

4. Please rate the following statement using the scale provided with 1 star = Strongly Disagree to 5 stars = Strongly Agree:
   I would like to engage in future GIP discussions.
   *

☆ ☆ ☆ ☆ ☆

5. What did you like best about today's forum?

6. What GIP-related topics would you most like to learn more about in the future?

7. Do you prefer brief single-topic forums or longer multi-topic forums?

- [ ] Single Topic
- [ ] Multi-Topic

8. What is the best way to gather stakeholder feedback and share information on GIP?

- [ ] Host data gathering or presentation sessions
- [ ] E-mail requests and updates
- [ ] Coordinate one-on-one meetings

9. Would you be open to providing additional input or data in advance of future virtual forums?

- ◯ Yes
- ◯ No

10. What grid-oriented projects/programs would you recommend Duke Energy investigate for future grid investments?

11. Due to COVID-19, all recent stakeholder sessions have been virtual. To help plan for future sessions, when would you like to see a shift to in-person sessions?

- ◯ Early 2022
- ◯ Mid 2022
- ◯ Late 2022
- ◯ Stay with virtual sessions

12. Name: *

Samuel J. Wellborn
Associate General Counsel

Duke Energy
1201 Main Street
Suite 1180
Columbia, SC 29201

o: 803..988.7130
f: 803.988.7123

sam.wellborn@duke-energy.com

December 14, 2021

VIA ELECTRONIC FILING

The Honorable Jocelyn G. Boyd
Chief Clerk and Executive Director
Public Service Commission of South Carolina
101 Executive Center Drive, Suite 100
Columbia SC 29210

Re: Joint Petition of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC To Establish a Consolidated Informational Docket for Review and Consideration of Grid Improvement Plans (NDI Opened Pursuant to Commission Order No. 2020-533)
Docket No. ND-2020-28-E

Informational Update

Dear Ms. Boyd:

On August 12, 2020, by Order 2020-533 in Docket No. 2019-381-E, the Commission approved Duke Energy Carolinas, LLC's and Duke Energy Progress, LLC's (collectively, the "Companies") joint request to establish an informational docket for review and consideration of its Grid Improvement Plan. As a result of that order, on August 14, 2020, the Commission opened the above-referenced NDI docket. Since that time the Companies have provided the Commission periodic updates related to its Grid Improvement Plan.

The Grid Improvement Plan is a decade-long plan of near- and long-term actions and investments designed to transform the power grid, making strategic, data-driven improvements to power a smart-thinking grid that is more reliable, more resilient, and built to meet the energy needs of customers today and into the future. The Companies have held a number of stakeholder meetings during the execution of the Grid Improvement Plan and will continue to do so. Most recently, the Companies held virtual forums on October 26, 2021 and November 8, 2021. As a follow-up to requests for more information during these virtual forums, the stakeholders were provided with the attached document providing additional details on the Companies' 2022-2024 South Carolina Grip Improvement plans.

The Companies will continue to inform stakeholders, the Office of Regulatory Staff, and the Commission on developments in the Companies' Grid Improvement Plans.

Kind regards,

Sam Wellborn

Attachment

cc: (via email w/ attachments)
Counsel for Office of Regulatory Staff
Counsel for Department of Consumer Affairs
Counsel for Sierra Club
Counsel for Walmart, Inc.
Counsel for SELC on behalf of SC NAACP, SCCCL & Upstate Forever
Counsel for Nucor Steel-South Carolina
Counsel for CCEBA and Cypress Creek Renewables
Counsel for SCEUC
Counsel for Vote Solar
Counsel for CMC Recycling
Hasala Dharmawardena

From: GIP-engagement
Sent: Monday, December 13, 2021 2:56 PM
Subject: South Carolina Grid Improvement Plan Informational Update
Attachments: SC GIP 2022-2024 Informational Packet.pdf

Good afternoon,

As a follow-up to requests for more information during this Fall's virtual forums, please see the attached document for additional details on the Company's 2022-2024 SC GIP plans.
This document will also be filed in Docket No. ND-2020-28-E.

If you have any questions or feedback, please feel free to reach out to: GIP-Engagement@duke-energy.com.

Thank you for your continued interest in Duke Energy's Grid Improvement Plan.

Melissa Chandler Murphy
Director, Stakeholder Engagement
Duke Energy Corporation | 40 West Broad Street, Suite 690 | Greenville, SC 29605
e: melissa.murphy@duke-energy.com

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
Docket No. ND-2020-28-E

South Carolina Grid Improvement Plan

As discussed in recent stakeholder engagement sessions, Duke Energy Carolinas, LLC's ("DEC") and Duke Energy Progress, LLC's ("DEP" and, together with DEC, the "Companies") Grid Improvement Plan ("GIP") focuses on better serving our customers, delivering reliable and resilient service to all communities we serve and preparing the grid for an energy future with diverse resource options. The Companies are improving the grid to reduce outage events impacting our customers and reduce the overall duration of outages when they occur. We're also strengthening the electric grid to make it more resistant to outages and making the grid more secure, to protect against the growing threat of cyber and physical attacks. And, we are transforming the grid to enable diverse energy resources, including cleaner energy options. Distributed energy resources ("DER") are important to our customers, and we believe growing these resources is an essential step towards building a cleaner energy future for South Carolina. Ultimately, these improvements will give customers more options and control to save energy and money.

As explained in past communications and most recently in the October 2021 webinar hosted by the Companies, the Grid Improvement Plan (e.g., GIP) was originally implemented to address seven macro "Megatrends" that were impacting the grid and shaping customer needs and expectations. Three years later, the Megatrends are continuing. As a result of the Megatrends and stakeholder feedback, the grid strategy must mature to balance outcomes across three objectives: resilience, DER enablement, and continued access to benefits for customers. While progress has been made in addressing these trends, continued improvement is needed.

Table 1 provides a list of the programs included in the GIP and the correlation to the megatrends being addressed by each program.

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
Docket No. ND-2020-28-E

Table 1: SC Grid Improvement Plan ("GIP") programs – Megatrends addressed

GIP PROGRAMS	I - Phys & Cyber Threats	II - Adv Tech (Solar/Battery)	III - Environmental Policy	IV - Weather	V - Grid Improv Tech	VI - Concentrated Growth	VII - Cust Expectation
Physical & Cyber Security	x	x			x		x
Self-Optimizing Grid	x	x	x	x	x	x	x
Integrated Volt/VAR Control	x	x	x	x	x	x	x
Harden &Resiliency [T]		x	x	x			x
Targeted Underground				x			x
Energy Storage		x	x	x		x	x
Transformer Retrofit [D]				x			x
Long Duration Interruptions				x			x
Transformer Bank Repl [T]		x	x				x
Oil Breaker Rpl [T/D]			x		x		x
Enterprise Communications	x	x	x	x	x	x	x
Distribution Automation		x	x	x	x		x
System lntelligence [T]		x	x		x		x
Advanced Enterprise Systems		x	x		x		x
ISOP/ADP		x	x		x	x	x
DER Dispatch		x	x		x		x
Power Electronics		x	x		x		x

Key Accomplishments – Thru September 30, 2021

The grid programs began to address the Megatrends by identifying ways to modernize the current grid structure while increasing reliability and integrating evolving technologies. Since beginning this work, we have made significant progress, as outlined below from a sample of GIP programs:

The *Self-Optimizing (SOG)* program redesigns key portions of the distribution grid into a dynamic, smart-thinking, self-healing grid with the ability to automatically reroute power around trouble areas, to quickly restore power to the maximum number of customers and to enable better management of local distributed energy resources. This helps to reduce the number of outages,

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
Docket No. ND-2020-28-E

decrease the duration of outages up to 75% when they do occur, and help restore power in a matter of minutes. This system can detect issues before a customer reports a power outage.

Self-healing networks continue to prevent millions of customer minutes of interruption in SC, including 33.2 million minutes inception-to-date as of September 30, 2021.

- To date, we have installed self-healing technology to serve 8.7% of customers in DEC and 47.2% of customers in DEP in SC.
- The automated self-healing technologies have operated at a high success rate when called upon, at 100% and 97% for DEC and DEP YTD 2021, respectively.

Integrated Volt-Var Control ("IVVC") program establishes control of distribution equipment in substations and on distribution lines to optimize delivery voltages to customers and power factors on the distribution line.

Optimizing delivery voltage means enabling grid operators to operate the distribution grid in a Conservation Voltage Reduction ("CVR") mode that supports voltage reduction and energy conservation on a year-round basis, for approximately 90% of the hours in the year. Beginning in 2023, customers will see the benefits from avoided fuel and capacity costs from lower voltage on the distribution line. Customers are already benefiting from increased operational efficiency and improved VAR management using the controls that have been installed to date.

Through September 2021, the IVVC program has installed 13% of the capacitors, installed 55% of the regulator controls, completed 6% of the substations and completed 17% of circuits.

- The project is on track to begin testing completed substations in 2022 and automated control of distribution voltage starting in 2023 and ramping up to full implementation on all targeted substations by 2025.
- Although IVVC construction is not scheduled to be completed until 2023, the equipment is already providing increased operational awareness to distribution grid conditions.

The *Substation Flood Mitigation* subprogram, which builds in protection of substations most vulnerable to flood damage, was completed in South Carolina. An example of this work can be seen at the Nichols substation which experienced flooding during Hurricane Matthew. A flood mitigation wall and gate were constructed to a depth of approximately 18 feet below ground and reaching 8-9 feet above ground.

- There has been an increase in extreme flooding events across the Southeast in the last decade, and meteorologists expect this trend to continue.
- The Carolinas have experienced at least four 500-year flood events since 2015.

The *Transmission System Intelligence* program deploys transformational system monitoring and control equipment to enable faster response to outages and more intelligent analysis of issues on the grid. Installations of intelligent communication equipment have been completed at twenty-one South Carolina substations (88 Carolinas system-wide) as part of the Transmission System Intelligence program.

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
Docket No. ND-2020-28-E

The data collected from digital relays and condition-based monitors helps better assess and optimize transmission asset health.

- The installation of transformational grid monitoring and control equipment will allow for faster analysis and response to events.
- Increased automation enables a dynamic self-healing and remotely operated grid that improves flexibility and reduces duration of outages.

The *Long Duration Interruption/High Impact Sites (LDI/HIS)* program is designed to improve the reliability for parts of the grid with high potential for long duration outages as well as for high-impact customers like airports and hospitals. These prolonged outages may be caused by issues such as the company's inability to quickly access equipment during storm restoration or lack of alternate existing ties to the grid to provide power to some customers while outage causes are addressed.

Notable completed projects to date include:

- Cheraw - Pee Dee River Crossing
- Moore to Woodruff Tie
- Greenville Health System Critical Care
- Eddy Rd to Panaroma Tie

The Enterprise Communication program modernizes and secures the critical communications between intelligent grid management systems, data and controls systems, and sensing and control devices. With this technology we can:

- Route trucks more effectively during storms
- Perform our day to day work more efficiently
- Capture and utilize data for more efficient operations

Additionally, the Enterprise Communications program addresses technology obsolescence, secures vulnerabilities and provides new workforce-enabling capabilities. A few program highlights include:

- Vehicle Area Network (VAN) – Telematics portion of VAN project has been completed, benefitting customers by our improved ability to route repair crews for quicker power restoration.
- Mission Critical Transport – replacement and expansion of the fiber optic communications network to ensure there is sufficient and reliable bandwidth to transport information across the grid thus supporting all of the our grid management devices, data and controls systems.
- Towers Shelters Power Supplies – replacement and expansion of communications towers as well as shelters and power supplies at tower locations allowing for more communication reliability and greater bandwidth to substations and intelligent grid devices.
- Next Generation Cellular – replacement of 2G/3G modems because of cellular provider phase out. These modems are being replaced with the newer 4G/5G modems in field locations to provide greater capacity, reliability, and security to the network.

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
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The *Cyber Security* program is focused on securing and improving risk mitigation on thousands of SCADA-controlled line devices (e.g. capacitors, regulators, recloser) through a combination of software and line device control upgrades.

- Through the completion of the Secure Access Device Management (SADM) project, the Companies are now able to better maintain passwords and retrieve fault files securely and remotely for thousands of SCADA controlled devices (i.e., regulators, capacitors, reclosers) in DEC and DEP.
- The Distribution Line Device Protection program completed the DEP Capacitor bank control upgrades in 2020 and the DEC recloser control changeouts in 2021. Future work will be required to continue upgrading line device controls.

The *Targeted Underground (TUG)* program strategically identifies the Companies most outage prone overhead power line sections and relocates them underground to reduce the number of outages experienced by customers.

The Targeted Underground program has converted more than 20 miles of outage prone parts of the system to underground. This maximizes outage elimination and allows for system restoration to occur more quickly and cost effectively to all customers in SC. Projects occurred in Chesterfield, Clarendon, Darlington, Dillon, Florence, Greenville, Lee, Marion, Spartanburg, Sumter, and Williamsburg counties.

The *ISOP* program integrates utility planning for generation, transmission, distribution and customer programs to improve the valuation and optimization of energy resources across the system.

The ADP Toolset (an ISOP tool) achieved full-scale deployment to distribution planners in the Carolinas in August 2021. Development of ADP tools and processes are transforming distribution planning by introducing automation to improve efficiency of complex analytical processes needed for DER deployment. The ADP Toolset will play a significant role in building a smarter, cleaner energy future as we strive to reduce CO_2 emissions.

Stakeholder Engagement Activities/Opportunities for Feedback

Following the initial filing of GIP information, we hosted four virtual forums for interested external GIP stakeholders, as detailed herein. On December 2, 2020, the Company reviewed its filed 2019 Annual Status Report with 13 external attendees who represented nine organizations. On May 12, 2021, the Company hosted another virtual forum to review the 2020 Annual Status Report with 13 external attendees who represented six organizations.

Two virtual forums were hosted on October 26 and November 8, 2021 to review preliminary plans for continuing the GIP work during the 2022-2024 timeframe and to request feedback from stakeholders. In the October 26 virtual forum, 14 external attendees representing ten organizations were present. In the November 8 virtual forum, 11 external attendees representing nine organizations were present. The Company appreciates the robust discussion and engagement that

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
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occurred during these Fall sessions. Participants proposed no changes to the 2022-2024 GIP plans put forth by the Company during these Fall sessions.

During all four virtual forums, stakeholders were given the opportunity to ask questions of and provide feedback to our program leaders. The Company plans to host an additional session to review the 2021 Annual Status Report in the second quarter of 2022.

Stakeholders requested more detail on continued plans for the 2022-2024 time frame, and we are providing this packet via email to all stakeholders and are happy to schedule a session to discuss this material upon additional request.

2022-2024 GIP Work

Preliminary capital spending expectations shared during the October and November virtual forums are shown below in Table 2. These estimated expenditures represent continued work within SC GIP programs for 2022-2024.

Table 2: Estimated Spend 2022 – 2024

Proposed Capital Expenditures by Program*	2022	2023-2024	Total 2022-2024
Self-Optimizing Grid	$53.1M	$85.0 – 103.9M	$138.1 - 157.0M
Distribution H&R – Flood Hardening	$2.7M	$10.7 – 13.0M	$13.3 - 15.7M
Distribution Transformer Retrofit	$2.9M	-	$2.9M
Integrated Volt/VAR Control	$44.0M	$27.2 – 33.2M	$71.2 – 77.2M
Transmission H&R	$25.0M	$40.6 – 49.6M	$65.6 – 74.6M
Transmission Transformer Bank Replacement	$12.0M	$15.8 – 19.3M	$27.8 – 31.3M
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Enterprise Communications	$22.3M	$33.7 – 41.2M	$56.0 – 63.5M
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ISOP	$1.9M	$2.9 – 3.5M	$4.7 – 5.4M
DER Dispatch Tool	$0.9M	$1.4 – 1.7M	$2.3 – 2.6M
Power Electronics for Volt/VAR	$0.8M	$3.7 – 4.6M	$4.6 – 5.4M
Physical and Cyber Security	$4.4M	$4.9 – 6.0M	$9.3 – 10.4M
Total	**$240.5M**	**$409.1 – 500.1M**	**$649.6 – 740.5M**

Note: Dollars presented here and throughout the document are representative of current plans; however, estimates may be subject to change as they are progressively matured. Impacts from supply chain delays, resource availability or other unforeseen circumstances may significantly impact current estimates.

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's
SC GIP 2022-2024 Informational Packet
Docket No. ND-2020-28-E

Program Summaries

Program level details for each of the programs included in the 2022-2024 GIP are provided in this section.

Integrated Volt/Volt Var Control

The IVVC program establishes control of distribution equipment in substations and on distribution lines to optimize delivery voltages to customers and power factors on the distribution grid.

Description

IVVC allows the distribution system to optimize voltage and reactive power needs. The program employs remotely operated substation and distribution line devices such as voltage regulators and capacitors. The settings for thousands of these controllable field devices are optimized and dispatched via a distribution management system.

IVVC capabilities enable a grid operator to lower voltage as a way of reducing peak demand (peak shaving), thereby reducing the need to generate or purchase additional power at peak prices or protecting the system from exceeding its load limitations. The current DEP **Distribution System Demand Response (DSDR)** program uses the peak shaving mode of IVVC to support emergency load reduction.

Another operational mode enabled by IVVC capabilities on the distribution system is **Conservation Voltage Reduction (CVR)**. CVR uses IVVC during periods of more typical electricity demand to reduce overall energy consumption and system losses. IVVC leveraged in CVR mode allows grid operators to maintain voltage in the lower end of the acceptable voltage range, mitigating voltage increases from distributed load sources. By lowering voltage levels, CVR also conserves energy and can reduce peak load by approximately 1-2% on average.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Increase distributed intelligence
- Enable voltage control
- Accommodate two-way power flow
- Increase hosting and capacity
- Modernize grid operations and planning

Integrated Volt/Var Control	2022	2023 - 2024	Total 2022 - 2024
DEC	$43.9M	$27.2 - 33.2M	$70.6 - 76.4M
DEP	$0.1M	$0.5 - 0.7M	$0.6 - 0.8M
Total (range of expected spend)	$44.0M	$27.2 - 33.2M	$71.2 - 77.2M

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Self-Optimizing Grid (SOG)

The Self-Optimizing Grid program, also known as the smart-thinking grid, redesigns key portions of the distribution system and transforms it into a dynamic self-healing network.

Description

The self-optimizing grid (SOG) uses self-healing technology to improve grid reliability. To detect potential faults in real time, the system uses sensors, switches, and controls. The self-healing system can recognize power outages and automatically adjust and minimize customer impact and restore power as quickly as possible. This helps to reduce the number of outages, decrease the duration of outages up to 75% when they do occur, and help restore power in a matter of minutes. This system can detect issues before a customer reports a power outage.

The SOG program reduces circuits to switchable segments to minimize the number of customers affected by sustained outages, expands the capacity to support the integrated grid network, and ensures the necessary connectivity to allow for rerouting options. SOG enables two-way power flows needed to support more rooftop solar, battery storage, electric vehicles, and microgrids – technologies that will increasingly power the lives of customers and move the state of South Carolina towards a cleaner energy future for all customers.

The current grid has limited ability to reroute or rapidly restore power and limited ability to optimize for the growing penetrations of distributed energy resources (DER). The SOG program is established to address both issues.

The SOG program consists of three (3) major components: grid capacity, grid connectivity, and automation and intelligence. The **SOG Capacity projects** focus on expanding substation and distribution line capacity to allow for two-way power flow. **SOG Connectivity projects** create tie points between circuits. **SOG Automation projects** provide intelligence and control for the Self Optimizing Grid. Automation projects enable the grid to dynamically reconfigure around trouble and better manage local DER.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Increase distributed intelligence
- Improve reliability
- Accommodate two-way power flow
- Increase hosting capacity

Self-Optimizing Grid	2022	2023 - 2024	Total 2022 - 2024
DEC	$34.5M	$56.0 - 68.4M	$90.5 - 103.0M
DEP	$18.6M	$29.0 - 35.5M	$47.6 - 54.1M
Total (range of expected spend)	$53.1M	$85.0 - 103.9M	$138.1 - 157.0M

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Power Electronics Program

The Power Electronics program helps to reduce power quality issues associated with high DER penetration, and ultimately improves reliability to customers.

Description

As the adoption of distributed energy resources (DER) (e.g., customer-owned solar and energy storage) reaches critical levels and microgrid technology matures, power electronic technology must also advance to appropriately detect and respond to rapid voltage and power fluctuations that often accompany non-dispatchable resources such as solar.

As clouds move across the daytime sky and momentarily block sunlight from reaching solar panels, solar generation immediately ceases. As sunlight peaks through openings in the cloud cover, the solar panels begin generating, creating power spikes and voltage instability on the circuit. These intermittent power impacts occur and then change at rapid rates (in some cases sub-second) and frequently faster than the legacy electro-mechanical voltage management equipment like regulators and capacitors can handle.

Integrating advanced solid-state technologies like power electronics (i.e., static VAR compensators and other solid-state voltage support equipment), better equips the distribution system to manage power quality issues associated with increasing DER penetration.

The program is still in its early stages and current plans are small pre-scale deployments to validate capabilities and benefits.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Improve reliability
- Enable voltage control
- Accommodate two-way power flow
- Increase hosting capacity

Power Electronics for Volt/Var	2022	2023 - 2024	Total 2022 - 2024
DEC	$0.4M	$1.2 - 1.5M	$1.6 - 1.9M
DEP	$0.4M	$2.5 - 3.0M	$2.9 - 3.5M
Total (range of expected spend)	$0.8M	$3.7 - 4.6M	$4.6 - 5.4M

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Distribution Automation (DA)

The DA program improves how the distribution system protects the public and itself from unsafe voltage and current levels and, significantly reduces the impact experienced by customers due to grid issues.

Description

The capabilities offered through DA can transform what may have been an hour-long power outage for hundreds or even thousands of homes and businesses into a momentary outage – or potentially help avoid an outage altogether.

The DA consists of several complementary efforts that work in concert to support dynamic and growing distribution system loads in a more sustainable way while minimizing power quality issues that often accompany a large-scale transition to solar power. One of these projects, **Urban Underground System Automation,** modernizes the protection and control of underground power systems that serve critical high-density areas, such as urban business districts and airports. These improvements provide automatic power restoration capabilities during outages in most cases along with device communications for remote system monitoring.

The **Fuse Replacement** project focuses on replacing one-time use fuses with automatic operating devices capable of intelligently resetting themselves for reuse, thus eliminating unnecessary use of resources (inventory, time, gasoline, etc.). When a fault occurs beyond these new fuse replacement devices, the customer will only experience a momentary blink instead of a sustained outage the majority of the time.

The **Hydraulic to Electronic Recloser** program replaces obsolete oil-filled (hydraulic) devices with modern, remotely operated reclosing devices that support continuous system health monitoring. In some case, the addition of remote-control capabilities can help expedite power restoration efforts by allowing remote operations after manual fault isolation during outages.

Such digital device upgrades offer further value through efforts like the **System Intelligence and Monitoring** program. The deployment of advanced diagnostic tools helps engineers and technicians address electrical disturbances on the distribution system and improve customer experience. For example we are adding fault indicating sensors with remote communication capabilities to help pinpoint the location of faults to help reduce the outage duration.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Increase distributed intelligence
- Improve reliability
- Modernize grid operations and planning

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Distribution Automation	2022	2023 - 2024	Total 2022 - 2024
DEC	$18.4M	$25.4 - 31.0M	$40.0 - 45.7M
DEP	$2.0M	$12.2 - 14.9M	$18.0 - 20.7M
Total (range of expected spend)	$20.4M	$37.6 - 45.9M	$58.0M - 66.4M

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Energy Storage

The Energy Storage program implements battery storage and other related non-traditional measures to defer, mitigate, or eliminate the need for traditional utility investments, such as line capacity upgrades.

Description

The program supports customer and utility initiatives through smart investments in storage for applications that deliver value to customers and the Company. These applications include microgrid projects for preventing planned and unplanned outages, as well as long-duration outage projects for providing redundant power sources for vulnerable (rural and remote) communities, and circuit and bank capacity projects using substation-tied energy storage.

Given the multiple applications energy storage technology supports, projects within the Energy Storage program are designed and assessed on a case-by-case basis for the specific challenge being addressed (e.g., long duration outage support, microgrid or emergency power support, auxiliary service needs, etc.).

The Energy Storage program also includes the development and deployment of an energy storage control system to manage the fleet of energy storage resources.

Grid Capabilities Enabled

- Improve reliability
- Increase distributed intelligence
- Enable voltage control
- Accommodate two-way power flow
- Increase hosting capacity (DER Enablement)
- Modernize grid operations and planning
- Expand customer options and control

Energy Storage	2022	2023 - 2024	Total 2022 - 2024
DEC	$.05M	$21.2 - 25.9M	$21.2 - 25.9M
DEP	$.02M	$8.1 - 9.9M	$8.1 - 9.9M
Total (range of expected spend)	$0.1M	$29.3 - 35.8M	$29.4 - 35.9M

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Integrated System Operations Planning (ISOP)

The ISOP program integrates utility planning for generation, transmission, distribution, and customer programs to improve the valuation and optimization of energy resources across the system.

Description

The energy resource mix is changing rapidly for electric utilities with the growth of renewable and distributed energy resources. Declining technology costs and policy support for renewable energy will likely make those resources increasingly competitive with traditional energy solutions. To properly compare these non-traditional solutions with traditional resources requires updates to utility planning processes. Integrated System Operations Planning (ISOP) process integrates utility planning for generation, transmission, distribution, and customer programs to improve the valuation and optimization of energy resources across all segments of the utility system to best serve electric customers.

The ISOP process addresses key operational and economic considerations across all segments of the system through integration and refinement of existing system planning tools and, in some cases, development of new analytical tools to assess characteristics that have not historically been captured or considered in long-term planning. Some examples include locational values for distributed resources, system ancillaries and reserves needed to support future operations, and energy resource flexibility to support new dynamic operational demands on the system.

ISOP is a multi-year development program to build the tools and processes needed to accommodate an increasingly integrated approach that will be required to optimize planning and operation of the electric utility system of the future.

Grid Capabilities Enabled

- Increase automation
- Increase distributed intelligence
- Improve reliability
- Enable voltage control
- Accommodate two-way power flows
- Increase hosting capacity

ISOP	2022	2023 - 2024	Total 2022 - 2024
DEC	$1.4M	$2.0 - 2.4M	$3.3 - 3.7M
DEP	$0.6M	$0.9 - 1.1M	$1.5 - 1.7M
Total (range of expected spend)	$1.9M	$2.9 - 3.5M	$4.7 - 5.4M

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Long Duration Interruption/High Impact Sites (LDI/HIS)

The LDI/HIS program is designed to improve the reliability for parts of the grid with a high potential for long duration outages as well as for high-impact customers like airports and hospitals.

Description

The LDI/HIS program is designed to improve the reliability in parts of the grid where the duration of potential outages is expected to be much higher than average. Focus areas for this program are radial feeds to entire communities or large groups of customers as well as inaccessible line segments (i.e. off road, swamps, mountain gorges, extreme terrain, etc.).

Many of the areas served by these long, rural, single-sourced feeders can experience significant impacts to the local economy and to quality of life when the entire town loses power. Further, operational and repair costs are generally higher than average in these areas due to the special equipment required.

While some sites may include extreme hardening, circuit relocations, new circuit ties and undergrounding, energy storage solutions may offer more cost-effective solutions for improving reliability and managing costs.

The LDI/HIS program is also designed to improve the reliability of high- impact customers like airports and hospitals, and high-density areas that could require a variety of infrastructure solutions to improve power quality and reliability. Typical projects include substation upgrades, circuit ties, voltage conversions, and reconductoring.

Grid Capabilities Enabled

- Improve reliability
- Harden for resiliency

LDI/HIS	2022	2023 - 2024	Total 2022 - 2024
DEC	$0.8M	$0M	$0.8M
DEP	$0M	$23.0 - $28.2M	$23.0 - $28.2M
Total (range of expected spend)	$0.8M	$23.0 - $28.2M	$23.8 - $28.9M

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Targeted Undergrounding (TUG)

The TUG program strategically identifies the Company's most outage prone overhead power line sections and relocates them underground to reduce the number of outages experienced by customers.

Description

Overhead power line segments with a history of unusually high numbers of outages drive a disproportionate amount of momentary interruptions and outages that affect our customers. When these segments of lines fail, they cause problems for customers directly served by them as well as customers upstream. Lines targeted to be moved underground are typically the most resource-intensive parts of the grid to repair after a major storm. Equipment on these line segments can experience shortened equipment life and additional equipment-related service interruptions.

The goal of the TUG program is to maximize the number of outage events eliminated. Converting outage prone parts of the system enables us to restore service more quickly and cost effectively for all customers. Addressing areas with outlier outage performance improves service while lowering maintenance and restoration costs for all customers.

Criteria for consideration in the selection of targeted communities include:

- Performance of overhead lines
- Age of assets
- Service location (e.g., lines located in backyard where accessibility is limited)
- Vegetation impacts (e.g., heavily vegetated and often costly and difficult to trim)

Grid Capabilities Enabled

- Improve reliability
- Harden for resiliency
- Modernize grid operations and planning

Targeted Undergrounding	2022	2023 - 2024	Total 2022 - 2024
DEC	$10.0M	$18.0 - 22.0M	$28.0 - 32.0M
DEP	$4.0M	$9.5 - 11.6M	$13.5 - 15.6M
Total (range of expected spend)	$14.0M	$27.5 - 33.6M	$41.5 - 47.6M

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Distribution Transformer Retrofit

The Distribution Transformer Retrofit program converts existing overhead distribution transformers to deliver the same reliability benefits as a modern transformer installed today.

Description

Like the Self-Optimizing Grid program, the new sectionalization capability of a retrofitted transformer works to minimize the number of customers impacted by fault or failure on the power line. In addition, like the Targeted Undergrounding program, the new protective features that mitigate equipment vulnerabilities work to significantly lower the risk of an outage occurring at the transformer all together.

The core activities of the transformer retrofit program include the installation of a fuse disconnect device on the high-voltage side of every overhead transformer to protect upstream customers from a fault at or downstream of the transformer. In addition, through protective device coordination, the local fused disconnect can be set to prevent any upstream operations of reclosing devices (the source of momentary outages for customers not served by the retrofitted transformer.)

Consistent with modern transformer standards, the program also retrofits transformers with additional protective elements to reduce the risk of external factors such as lightning strikes and animal interference. Lightning strikes cause outages by raising voltage levels of equipment past operating levels while animals cause outages by either chewing equipment or creating a connection between equipment thus causing faults.

Grid Capabilities Enabled

- Improve reliability
- Modernize grid operations and planning

Distribution Transformer Retrofit	2022	2023 - 2024	Total 2022 - 2024
DEC	$0M	$0M	$0M
DEP	$2.9M	$0M	$2.9M
Total (range of expected spend)	$2.9M	$0M	$2.9M

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Distribution Hardening & Resiliency – Flood Hardening

The Distribution H&R – Flood Hardening targets areas where an overlay of actual outage events from Hurricanes Matthew and Florence intersect with the 100-year flood plain.

Description

In hurricane events like Hurricane Floyd and more recently Hurricanes Matthew and Florence, significant flooding was a major factor impacting restoration. Smart, targeted investments can mitigate the scale of impacts on communities and customers adjacent to these areas prone to extreme flooding. Hardening lines and structures is a balanced approach that can keep power and critical services available to some portion of a community and prevent a widespread outage in an area until flooding recedes.

This program includes the following:

- Alternate power feeds for substations in flood-prone areas, and for radial power lines that cross into and through flood-prone areas
- Hardened river crossings where power lines are vulnerable to elevated water levels and where access issues may occur during extreme flooding
- Additional guying for at-risk structures within flood zones to prevent poles and equipment from being displaced and remain upright

Grid Capabilities Enabled

- Improve reliability
- Harden for resiliency
- Improve physical security

Distribution H&R – Flood Hardening	2022	2023 - 2024	Total 2022 - 2024
DEC	$2.5M	$1.7 - 2.1M	$4.2 - 4.6M
DEP	$0.1M	$9.0 - 11.0M	$9.1 - 11.1M
Total (range of expected spend)	$2.7M	$10.7 - 13.0M	$13.3 - 15.7M

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Transmission System Intelligence

The Transmission System Intelligence program deploys transformational system monitoring and control equipment to enable faster response to outages and more intelligent analysis of issues on the grid.

Description

Transmission grid automation improvements will reduce the duration and impacts associated with transmission system issues.

Improvements in transmission system device communication capabilities enable better protection and monitoring of system equipment. The data collected from intelligent communication equipment helps better assess and optimize transmission asset health.

The Transmission System Intelligence program includes:

- The replacement of electromechanical relays with remotely operated digital relays,
- The implementation of intelligence and monitoring technology capable of providing asset health data and driving predictive maintenance programs, and
- The deployment of remote monitoring and control functionality for line and substation devices for rapid service restoration.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Improve reliability
- Accommodate two-way power flow
- Modernize grid operations

Transmission System Intelligence	2022	2023 - 2024	Total 2022 - 2024
DEC	$8.9M	$7.4 - 9.0M	$16.3 - 17.9M
DEP	$1.1M	$1.2 - 1.5M	$2.3 - 2.6M
Total (range of expected spend)	$10.0M	$8.6 - 10.5M	$18.6 - 20.5M

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Transmission Hardening & Resiliency

The Transmission (H&R) program works to create a stronger and more resilient transmission grid capable of withstanding or quickly recovering from extreme external events, natural or man-made.

Description

Each Transmission H&R sub-program works to address unique challenges in ways that harden the system, and not only minimize impacts to customers, but enhance their electric service experience. The **44-kV System Upgrade** subprogram both protects the 44-kV system from extreme weather, but also paves the way for more DER interconnections by creating additional capacity on the system to transport generation from large scale solar sites. Similarly, the **Targeted Line Rebuild for Extreme Weather** subprogram protects some of the higher voltage transmission lines from extreme weather by addressing vulnerable wooden structures.

The **Substation Flood Mitigation** subprogram builds in protection for substations most vulnerable to flood damage; and the **Animal Mitigation** subprogram installs equipment specifically designed to prevent animal induced events from impacting customers directly through an outage or indirectly through a system perturbation such as a voltage depression. Altogether,

these H&R efforts not only enhance the functionality of individual assets, but substantially improve the overall functionality of the system, particularly under extreme weather conditions.

The long-term plan for hardening and resiliency is to relocate or strengthen at-risk assets or other solutions such as flexible mitigation at that site.

Grid Capabilities Enabled

- Improve reliability
- Harden for resiliency
- Improve physical security
- Accommodate two-way power flow
- Optimize hosting capacity for DER

Transmission H&R	2022	2023 - 2024	Total 2022 - 2024
DEC	$21.4M	$39.7 - 48.5M	$61.1 - 69.9M
DEP	$3.6M	$0.8 - 1.0M	$4.5 - 4.6M
Total (range of expected spend)	$25.0M	$40.6 - 49.6M	$65.6 - 74.6M

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Transformer Bank Replacement

The Transformer Bank Replacement program leverages new system intelligence capabilities to target transformers before they fail and optimizes hosting capacity for DER penetration.

Description

Predictive and proactive replacement programs like Transformer Bank Replacement significantly reduce the impacts and costs of replacement when compared to performing the same work following a catastrophic failure. In addition, the transformers are evaluated for hosting capacity to support future adoption of distributed energy resources (DER). As part of the transformer replacement, advanced protection and control devices will enable two-way power flow from future DER connections.

The objective of this program is to anticipate future transformer failures and replace those transformers in an orderly fashion, avoiding the cost and customer outage minutes associated with these failures. Catastrophic failures often result in significant oil spills, requiring expensive cleanup and other mitigation.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Improve reliability
- Modernize grid operations & planning
- Optimize hosting capacity of DER

Transformer Bank Replacement	2022	2023 - 2024	Total 2022 - 2024
DEC	$9.0M	$7.0 - 8.6M	$16.1 - 17.6M
DEP	$3.0M	$8.8 - 10.7M	$11.8 - 13.7M
Total (range of expected spend)	$12.0M	$15.8 - 19.3M	$27.8 - 31.3M

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Breaker Replacement

The Breaker Replacement program identifies and replaces oil-filled circuit breakers on the transmission and distribution systems with modern technology.

Description

The purpose of this program is to replace these legacy assets with breaker technology capable of two-way communications and remote operations. Looking forward, these fast-response gas and vacuum breakers are better suited for protecting circuits with higher solar and other variable energy resource penetration.

Transmission level oil breakers will be replaced with modern sulfur hexafluoride gas (SF6) circuit breaker technology. The medium voltage distribution level oil-filled breakers will be replaced with modern vacuum circuit breaker technology.

The new communication and control capabilities of this modern technology better positions the transmission and distribution systems to work with grid automation systems to better respond to electric grid events.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Improve reliability
- Modernize grid operations and planning

Oil Breaker Replacement	2022	2023 - 2024	Total 2022 - 2024
DEC	$20.0M	$40.5 - 49.5M	$60.5 - 69.5M
DEP	$4.1M	$15.6 - 19.0M	$19.6 - 23.1M
Total (range of expected spend)	$24.1M	$56.1 - 68.5M	$80.2 - 92.6M

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Physical & Cyber Security

The Physical and Cyber Security program protects against potential risks and reduces impacts of attacks on the electric grid.

Description

This portfolio focuses on hardening the physical and cyber security of the substations above the standard regulatory compliance requirements. Transmission elements of the program include:

- Enhancements to physical security measures and increased monitoring capabilities at substations that are critical to the reliability of the grid.
- Replacement of Windows-based relays to address cyber security standards.
- Enhancement to cyber security at non-bulk electric system (BES) substations
- Increase protection against Electromagnetic Pulse and Intentional Electromagnetic Interference (EMP/IEMI).

At the distribution system level, much of the focus involves securing and improving risk mitigation of remotely controlled field equipment. An example is enabling door alarms and entry notifications. Another example is enabling password maintenance and retrieval of fault files securely and remotely for the thousands of line devices in DEC and DEP.

Programs include:

- Distribution Line Device Cyber Protection
- Secure Access Device Management (SADM) - a single tool to remotely and securely perform device management activities and event record retrieval on the entire transmission and distribution device inventory.

Grid Capabilities Enabled

- Harden for resiliency
- Improve cyber security
- Improve physical security
- Increase monitoring and visibility
- Increase automation
- Improve reliability

Physical & Cyber Security	2022	2023 - 2024	Total 2022 - 2024
DEC	$3.0M	$0.2 - 0.3M	$3.2 - 3.3M
DEP	$1.5M	$4.6 - 5.6M	$6.0 - 7.0M
Total (range of expected spend)	$4.4M	$4.9 - 6.0M	$9.3 - 10.4M

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Enterprise Communications Advanced Systems

The Enterprise Communications program modernizes and secures the critical communications between intelligent grid management systems, data and controls systems, and sensing and control devices.

Description

The program addresses technology obsolesce, secures vulnerabilities, and provides new workforce-enabling capabilities. This program includes improvement and expansion of the entire communications network from the high-speed, high-capacity backbone fiber optic and microwave networks to the wireless connections at the edge of the grid. These upgrades help build the secure communications required for the increasing number of smart components, sensors, and remotely activated devices on the transmission and distribution systems.

Key communication efforts are: (1) *Mission Critical Transport* which strategically upgrades the infrastructure required for high-speed, reliable, sustainable, interoperable communications for grid devices and personnel; (2) *Grid Wide Area Network* (Grid WAN) which improves network reliability, performance and security for current grid management/control applications; (3) *Mission Critical Voice* which replaces current Land Mobile Radio systems with enhanced, reliable, sustainable, interoperable communications across all service territories; and (4) *Next Generation Cellular* which replaces obsolete 2G/3G cellular technology with the more reliable and secure 4G/5G technology required for modern grid devices in the field.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Improve reliability
- Enable voltage control
- Accommodate two-way power flow
- Improve cyber security

Enterprise Communications Advanced Systems	2022	2023 - 2024	Total 2022 - 2024
DEC	$14.4M	$23.7 - 29.0M	$37.8 - 43.1M
DEP	$8.3M	$10.0 - 12.3M	$18.2 - 20.4M
Total (range of expected spend)	$22.3M	$33.7 - 41.2M	$56.0 - 63.5M

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Enterprise Applications

The Enterprise Applications program deploys the systems and upgrades needed to monitor the health and security of the grid and analyze data to enable grid automation and optimization technologies.

Description

Upgrades to existing enterprise applications enable system optimization and overall better system performance. Within the program, there are two main components responsible for the delivery of enterprise technology solutions that support transmission, distribution, and other critical lines of business: (1) *Enterprise Systems* and (2) *Grid Analytics*.

This effort focuses on delivering transformative, cross-functional technical solutions to the enterprise in non-disruptive ways. The *Outage Timestamp Accuracy* project integrates outage data from Advanced Metering Instructure (AMI) to improve the accuracy of historical outage data.

Grid Analytics optimizes the electric system health and performance through the deployment of the *Health Risk Management* (HRM) tool and *Enterprise Distribution System Health* (EDSH) tool. These tools help to prevent equipment failures and improve asset performance on the transmission and distribution systems, respectively.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase automation
- Increase distributed intelligence
- Improve reliability
- Enable voltage control
- Accommodate two-way power flow
- Improve physical security

Enterprise Applications	2022	2023 - 2024	Total 2022 - 2024
DEC	$0.8M	$1.1 - 1.3M	$1.9 - 2.1M
DEP	$0.3M	$0.2 - 0.3M	$0.5 - 0.6M
Total (range of expected spend)	$1.1M	$1.3 - 1.6M	$2.4 - 2.7M

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DER Dispatch Enterprise Project

The DER Dispatch Enterprise Project is a software-based solution that provides operators with the ability to monitor and manage both transmission and distribution connected DERs.

Description

This tool project will coordinate with the Distribution Management System (DMS) and Energy Management System (EMS) to improve the way DERs are integrated in the energy supply mix, both at the Distribution and the bulk power level.

By providing system-wide visualization and control of large-scale DERs, the DER Dispatch Tool Project will enable system operators to model, forecast, and dispatch a portfolio of distributed energy resources, like solar generation, and energy storage, based on system conditions and real-time customer demand. This tool project will help meet the need to match energy demand with supply, especially in emergency conditions.

Current processes and tools provide system operators with a rudimentary ability to quickly shed large blocks of solar generation in emergency conditions to meet standards for real power control. The proposed solution will provide operators with a more automated and refined toolset to optimize management of both utility and customer owned DERs to meet system stability requirements.

DER Dispatch increases grid capabilities resulting in more DER interconnections. Absent this tool, the grid will reach a threshold where DER interconnections will no longer be accepted due to safety and reliability risks. Hence, DER Dispatch is an operational tool that permits real time control. For example, a DER Dispatch operation could mitigate an emergency condition such as an over-generation event by dispatching utility and third-party owned DERs (i.e. solar farms/energy storage sites/etc.). Since DER Dispatch enables precise grid control, then more DERs can interconnect with the grid. Future phases for DER Dispatch include economic dispatch which will influence our participation in SEEM through the aggregation of utility and third-party owned DERs. Economic dispatch furthers the expansion of DERs thus increasing the overall economic development in a geographic region.

This system will replace an existing tool in DEP that is used to dispatch distribution connected solar in 50 MW increments.

Grid Capabilities Enabled

- Increase monitoring and visibility
- Increase distributed intelligence
- Enable voltage control
- Accommodate two-way power flow
- Expand customer options and control

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DER Dispatch Enterprise Project	2022	2023 - 2024	Total 2022 - 2024
DEC	$0.7M	$1.1 - 1.3M	$1.8 - 2.0M
DEP	$0.2M	$0.3 - 0.4M	$0.5 - 0.6M
Total (range of expected spend)	$0.9M	$1.4 - 1.7M	$2.3 - 2.6M